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ARCHIVES

OF

OTOLOGY

EDITED IN ENGLISH AND GERMAN

BY

DR. H. KNAPP,
OF NEW YORK.

PROF. S. MOOS, M. D.,
OF HEIDELBERG.

AND

DR. D. B. ST. JOHN ROOSA,
OF NEW YORK.

IN CONJUNCTION WITH

Dr. C. R. AGNEW, of New York; Prof. E. BERTHOLD, of Königsberg; Dr. G. BRUNNER, of Zurich; Dr. SWAN M. BURNETT, of Washington; Dr. E. GRUENING, of New York; Dr. A. HARTMANN, of Berlin; Dr. L. LOEWE, of Bern; Dr. C. J. KIPP, of Newark; Dr. B. LOEWENBERG, of Paris; Dr. J. PATTERSON CASSELS, of Glasgow; Prof. E. DE ROSSI, of Rome; Dr. R. SCHALLE, of Hamburg; Dr. H. STEINBRUEGGE, of Heidelberg; Dr. O. WOLF, of Frankfurt-on-the-Main; Prof. R. WREDEN, of St. Petersburg; and many others.

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ARCHIVES OF OTOLOGY.

REPORT OF THE PROCEEDINGS OF THE SECTION
OF OTOLOGY AT THE FIFTY-SECOND MEETING
OF THE GERMAN ASSOCIATION OF PHYSICIANS
AND NATURALISTS AT BADEN-BADEN, SEPT., 1879.

BY A. HARTMANN, OF BERLIN.

Translated by SWAN M. BURNETT, of Washington.

I. FIRST SESSION: President, Prof. MOOS.

I. Dr. Kuhn (Strasburg), made a communication on *the membranous labyrinth of the amphibians*.

The inner ear of the osseous fishes can be considered as the prototype for all the vertebrates, and the labyrinth of the various classes of amphibians can also be traced back to the same. The upper portion does not differ in any particular from that of the teleosts except in the matter of size. On the other hand, the inferior portion is found already in a state of considerable development in the amphibians. The two papillæ basilares, which are found in the osseous fishes on the boundary between the utricle and saccule, are in the proteus converted into a single large one; in the sirens and salamanders, and especially in the batrachians, there is formed at this place an independent oval organ, the pars initialis cochleæ supplied with crista and cupula terminalis.

Moreover on sirens, tritons and salamanders appears for the first time a pars basilaris, a cochlear part consisting of an oval cartilaginous ring, on which the distribution of the nerves and the cupula are the same as in other places where nerves end. In batrachians the organ has attained considerable development. The cochlea proper of the amphibians consists therefore of three distinct parts; the pars initialis, the pars basilaris, and the lagena, each one provided with its proper nerve branch. The minute structure of each individual crista and macula is the same in all

parts of the amphibian labyrinth, whether vestibule or cochlea. The nerve enters through the cartilaginous *basis* into the epithelial layer which constitutes the *auditory ridges*; on the cartilage lie round cells with large nuclei, the so-called basis-cells. They serve as a supporting cushion to the larger cylindrical cells which rest on them, and at the lower end of which the fine axis cylinder enters. Sometimes, the nerve fibre can be followed to the large nucleus of the cylindrical cell, and at times through the cell to its upper surface. Between the basis and cylindrical cells, the finest branches of the nerve form a so-called intra-epithelial network. At other times, the fine axis cylinders ascend between two cylindrical cells to terminate on the free surface of the crista. The thread-like cells which are found in the nervous epithelium of the cristæ of fishes, are not to be found in the amphibians. All remaining details; memb. tectoria, cupula, etc., are the same in these vertebrates as in the fishes.

2. Moos, Prof.: *On Minute Histological Alterations in the Labyrinth.*

Moos gave an account of the histological conditions in the labyrinth of the petrous bone of a man of 49 years, who died in the Marburg Insane Asylum of a hemorrhagic pachy-meningitis, and who after repeated so-called paralytic attacks inside of a year's time had completely lost his hearing.

The right petrous bone was found in that condition usual to purulent middle ear catarrh, the left in that found in simple chronic catarrh.

The alteration in the labyrinth consisted in microscopically demonstrable hemorrhage, with numerous transformations of the blood into pigment. The position, color and form of the pigment were clearly pointed out, and the significance of the granular cells found near the pigment were shown as standing in close connection with the absorption of the extravasated blood.

As a consequence of the hemorrhage there was inflammation. The microscopical substratum of the inflammation was demonstrated by cross sections of the membranous tissues of the labyrinth, and illustrated by the speaker by means of drawings. The inflammation led in part to a hyperplasia of the connective tissue elements, which however, did not remain entirely hyperplastic, but again underwent a partial fatty degeneration. Along with this there was found a partial atrophy, resp. degeneration of the epi-

thelial tissue and nerve, with which last there was associated the highest degree of atrophy with abundant colloid formation. There were, moreover, in the atrophic parts of the nerve, numerous molecular fat globules which Moos regarded as standing in intimate connection with the resorption of the decayed myeline. The atrophy can be followed to the ganglion cells as well as from the trunk of the porus. acust. int. on one side up to Rosenthal's canal, and on the other to the terminal nerve fibres of the crista of the ampullæ, etc. An explanation by means of appropriate drawings was given.

The speaker showed drawings which demonstrated that these terminal filaments blend with nerve-cells. The further consideration of this, however, he reserved for another communication.

In conclusion Moos spoke of the connection between the alterations in the labyrinth and the intracranial process, and in proof exhibited some drawings showing the similarity of the alteration in the vascular territory of the art. aud. int. to that of the art. meningea, as already clearly described by Kremiansky and Rindfleisch.

In the discussion which followed, the various methods of preparation were explained. The decalcification was accomplished by Moos in accordance with a prescription of Waldeyer, which consists in immersion in a successively thinned chromic acid solution, with later addition of nitric acid, by which means the employment of osmic acid does not become absolutely necessary. Kuhn advised caution in the use of acids, since many alterations of the epithelium can be imputed to the action of acids. Gottstein used the hydrochloric acid only after the finer tissues had become hardened. In his researches, the labyrinth was first opened, hardened and then decalcified.* Gerlach considered the employment of hydrochloric acid as injurious on account of the swelling of the connective tissue fibres, and gave preference to solutions of chromic acid gradually increased in strength.

3. Hedinger, Dr. (Stuttgart): *On exostoses in the external auditory canal and their treatment.*

Hedinger found on a patient who had been suffering for a year from a purulent middle ear catarrh, an immovable swelling in the external meatus of bony hardness. By pressure on the parts about

*In reply to an inquiry of Gottstein in the Naturalists' Association, Waldeyer spoke in a definite manner on this point. He "*first hardened* and then decalcified."

the ear, pus issued from under the new formation, and roughened bone was found by sounding. Great redness and swelling were present, with fluctuation over the mastoid process. A Wilde's incision was made and a fistulous canal found to enter the external meatus. The tumor in the meatus was considerably reduced in size by laminaria tents so that a necrotic piece of bone 8 mm. long and 4 mm. wide could be extracted from the inferior wall of the meatus through the opening. Fragmentary pieces of the new formation were removed by way of the mast. process by means of the chisel. Granulations and even ossification again occurred in the meatus, which were removed by means of a sharp spoon through the external meatus. Healing was at the time of speaking not yet completed. The speaker exhibited microscopical specimens of the removed exostoses.

In the discussion, Dr. Stimmel (Leipzig), gave an account of a patient in whom the exostoses had formed on the posterior wall of the meatus, likewise in the course of a purulent inflammation. Stimmel employed the dry treatment used by him in otorrhœa, consisting of the insertion of thymol wadding, by which means in a short time a very perceptible diminution of the extosis was effected. After a treatment of some weeks, a considerable lessening in size was noted, and finally a complete healing was effected. The case was exhibited to the Medical Society at Leipzig.

SECOND SESSION.—President, DR. GOTTSTEIN, Breslau.

1. Dr. O. WOLF, (Frankfort on-the-Main,) spoke of a case of *Tumor of the tonsilla cerebelli, which for two years had shown that group of symptoms known as Ménière's disease.*

The patient was a strong and, up to that time, to all appearances, a healthy man, of 46 years, from Wiesbaden. He consulted the speaker two years before, for the first time, on account of a violent tinnitus, particularly in the *left* ear. Examination showed a considerable diminution of hearing distance for the left ear, a less for the right (3' resp. 10'), together with a marked inability to hear certain series of tones, and a confusion of consonant sounds. The subjective noises assumed different phases, as singing, boiling, ringing and hissing. The conducting apparatus on both sides showed no abnormality, and none had been previously remarked by the patient. Iodide of potassium in increasing doses was ordered internally, and tr. iodine to be applied to the mast. process, in accordance with the opinion that the trouble was

seated in the nervous apparatus of hearing. The instructions were, however, not strictly carried out by the patient. Potass. iodid. was given later, but with no result. For a year the tinnitus and impaired hearing remained essentially the same, when, after a sea-bath, vertigo, nausea and vomiting occurred, and at the same time the hearing power on the *left* side sank so low that loud speech could be heard only close to the ear. During the second year of the disease there were frequent attacks of vertigo of greater or less intensity, especially on raising the head, but there was no inclination to fall in any particular direction. The patient consulted a large number of prominent physicians. The use of the constant current gave some relief, especially as regarded the tinnitus. Last spring (two and a half years from the beginning of the trouble) there was noted by the attending physician, a ptosis and dilatation of the pupil on the left side, to which was added a severe headache confined to the left parietal region. The patient could go about only with assistance, and stepped high like a cock. After the first of July he was confined to his bed, and the head could not be elevated without assistance; the muscles of the neck were sometimes tender on pressure, but there was no contraction. The patella-reflex was normal, and the cutaneous sensibility unaltered. Four weeks before death, facial paralysis set in on the left side. The sensorium up to this time was clear, yet there was at times maniacal excitement with delusions. The *left* ear was completely deaf, but the hearing distance for conversation remained in the *right* up to the time of death at 20-25 feet. For the last few weeks of life the tinnitus was complained of much less than before, but the pain in the parietal region was frightful. There was constipation, and the urine either passed involuntarily or had to be drawn off with a catheter. At the beginning of July speech became difficult, slow, and assumed a peculiar rattling character (nerv. hypoglossus?).

Death occurred after a paralysis of the palate under pneumonic symptoms.

Post-mortem: The cranial bones showed nothing abnormal, but in the tonsilla cerebelli on the *right* side there was found a tumor the size of a cherry, reddish-brown, vascular, with an uneven surface, which had pressed upon the origin of the acoustic nerve in the fourth ventricle in such a manner as to obliterate the striæ acousticæ on that side; hence paralysis affecting the *left* auditory nerve. Aside from this, the meninges, especially at the base of

the brain, were in a state of inflammation, which had in places gone on to the formation of connective tissue fibres. The ependyma of the ventricle was opaque and infiltrated with granules. A *second smaller tumor*, the size of a hazel-nut and of similar structure, was found in the cortical portion of the cerebrum on the right side near the sulcus in the gyrus cent. post. In the vicinity of the tumor the cerebral tissue was softened. (Demonstration of the preparation). It is not unlikely that there is an intimate connection between the attacks of mania, the severe parietal headache and the growth of this tumor. The left tympanum and arches were freely laid open, but nothing abnormal was found microscopically. As regards the genesis of the two tumors, it may be of interest to state that in the arteria basilaris numerous foci of endo-arteritis were found. A microscopical examination of the tumors showed a rich growth of so-called granulation cells, with numerous vessels, and in many places connective tissue fibres. There can be scarcely any doubt, therefore, that they were gummata. The patient had, as it was afterward discovered, undergone an inunction cure twenty years before, but had since that time remained entirely free from syphilitic symptoms, and had perfectly healthy children.

The speaker remarked in conclusion, that alterations in the cerebellum, which have their seat in the vicinity of the origin of the acusticus, as in the case just related, begin with subjective noises, and cause destruction of the sense of equilibrium, and thus for a time may be confounded with labyrinthine troubles, until implication of other nervous tracts clearly points out the central cause.

2. REHMANN, Dr., Langenbrücken: *A Musical Triangle.*

As a musical triangle the speaker described a configuration of the vocal cords, by which on their surface a triangle is to be discovered that is acute or obtuse according to the tone register of the individual examined. He thinks that by such a triangle, some conclusion can be drawn as to the tone formation, which would be of value in instruction in singing.

3. DR. SCHALLE, Hamburg: *Exhibition of Instruments, etc.*

Schalle exhibited an Ash's mouth spatula as modified by himself, which, by the employment of a tongue-plate, that can be lengthened or shortened, can be employed for heads of all possible sizes.

He also exhibited various irons and snares for cauterization, the formation of cicatrices, and the snaring-operation in the auditory apparatus and naso-pharyngeal space, especially a covered sickle-shaped and a semicircular iron, which being introduced through the nose, can be guided by means of the finger introduced through the mouth, as in using Meyers' circular knife, and applied to adenoid vegetations and hypertrophied pharyngeal tonsils.

A thimble-iron could also properly be employed for the same purpose.

A cautery-handle was also shown which can be held with only three fingers, and which is remarkable for its lightness (24 *grm.*) and small size (4, 5 *cm.*), as well as a snare-holder provided with a revolving wheel, which is intended for operations on vascular structures.

He also exhibited a very simple arrangement for testing the heat-intensity of snares.

Finally, he exhibited an operating chair adapted for bodies of all sizes, which guarantees the complete steadiness of the body and is especially adapted for operations on nervous people and children.

In conclusion, the speaker gave it as his opinion that operations on adenoid vegetations, except hypertrophy of the tons. pharyng., should not be performed, as is commonly advised, in quick succession, but at intervals of six, eight or more weeks, because, as often happens in operations of the tons. palat., the atrophy following the operation often spares the physician and patient any further interference.

A discussion followed on the frequency of adenoid vegetation and hypertrophy of the pharyngeal tonsils in various localities.

Whilst these affections, according to WOLF, are not common in the dry climate of Frankfort-on-the-Main, as is also the case in Strasburg according to the experience of KUHN, SHALLE has met with a large number of cases in Hamburg.

As regards operation on growths in the naso-pharyngeal space, Moos stated that he seldom operated on children under twelve years, but treated them by means of caustics applied by way of the nose or pharynx: in the former cases by means of Zaufal's funnel. GOTTSTEIN succeeded in some cases in destroying the growths by using the galvano-cautery through Zaufal's funnel. If the galvano-cautery is allowed to cool while in the growth, the

tissue will remain adherent to it, and will come away with it. If no pain accompanies the cauterization, it is evident that there has been no injury to the neighboring parts.

THIRD SESSION.—President, Dr. SHALLE, Hamburg.

1. Dr. L. GERLACH (Erlangen): *Preservation of human pharyngeal and aural preparations according to van Vetter's glycerine method.*

The advantage of van Vetter's method of treating anatomical preparations consists in the preservation of the flexibility of the specimen. The specimen is allowed to remain for from three to six weeks in a mixture of six parts by weight of glycerine, one of brown sugar and one-half of nitrate of potash, and then hung in the open air for from two to six months. Since in this method there is a formation of the crystals of nitrate of potash and sugar on the surface of the specimen, the speaker has used a mixture containing double the quantity of glycerine. Aural and pharyngeal preparations are especially well preserved by this method. In the aural preparations exhibited, the vibration of the M.T. and the movements of the bones were clearly seen. The transference of vibration, as in Politzer's inflation, from the M.T. to a manometer placed in the labyrinth, was also shown. On the pharyngeal preparations the action of the various muscles on the tension and position of the vocal cords was demonstrated.

2. Dr. KUHN (Strasburg) exhibited the *audiometer of Hughes* recently so strongly recommended by Richardson of London. This instrument consists of two Leclanché's elements, which are connected with a small microphone; there is a wire which connects this last with a coil fastened to the end of a graduated scale; it is then coiled for a length of 100 metres, and connected with another wire at the other end of the scale; it is then coiled for a length of six metres, and finally again joined to the two elements. When the lever lying on the microphone is moved to and fro on the needle suspended free near it, a slight noise is produced which is communicated to the current in the wire. A movable coil of 100 metres length of wire is now inserted between the two first coils, and a telephone is connected with it. In the last of the coils there is an induction current, which contains the noise of the microphone and communicates it by means of the telephone to the ear of the experimenter. Between the two primary coils there is a point in which the two opposing currents neutralize each other

—a zero point, at which there is no current, and where, of course no sound is produced. If, now, the secondary coil is moved gradually toward the primary coil, the induced current in the secondary coil will become stronger, until finally, when it is quite close to the primary coil, the noise is so loud that those almost completely deaf can hear it. This last point, which corresponds to the highest degree of deafness, Hughes has marked as 200. Between one and 200 are to be found all degrees of acuteness of the hearing power for the given sound.

The speaker was not yet in a position to examine the instrument in all its points. He would remark, however, that it gave much closer results as to the perception of noises than the acoumeters hitherto in use; and furthermore, it enabled us to mark the increase and diminution of the hearing power during the course of a disease respecting treatment very accurately. He deemed it necessary, however, that the microphone used in connection with it be improved, since an inequality in the movement of the lever gave rise to a corresponding inequality in the sound, though the difference is much less than one would *a priori* suppose. Account should also be taken of the weakening of the constant current; and it is very doubtful whether the apparatus can be so constructed that the same results can be obtained by different experimenters.

HARTMANN said, in the discussion that followed, that in the construction of apparatus to measure hearing power, the difficulty was to preserve a fixed tone. He himself obtained different tones in the telephone during the regular interruption of the current by means of an oscillating steel rod; according as the steel rod, by means of a special contrivance was shortened or lengthened, a higher or lower, very pure tone was produced. It happened, therefore, in this way, that by a moderately strong current only tones from 400 vibrations to the lowest could be obtained. There yet remains to be constructed an apparatus by which a required number of regular current interruptions can be produced.

HARTMANN, Dr., (Berlin): *Contributions to rhinoscopy.*

The speaker employs in those cases, where it is not possible with ordinary rhinoscopy to obtain a full view of the upper portion of the pharynx, a palate hook, which offers as an advantage over the means usually employed for this purpose, that it remains fixed in its position, and no assistant is required to keep it in place.

The instrument consists, in the first place, of a palate-hook with a straight handle and a curved concave surface, which must be the broadest at the part which goes above the palate; in the second place, of a contrivance by means of which the end of the handle can be introduced into one of the nostrils and made fast there. This contrivance has a letter S curve, whose lower shank is composed of a tube into which the handle of the hook is inserted and made fast by means of a screw. At the upper end of the S there is at right angles to it a bar, consisting of a steel pen, which passes at right angles to the apparatus into one of the nostrils, and rests on its floor.

The instrument can be employed with advantage; 1. when one wishes to examine one's own pharynx. The speaker succeeded at the first attempt on himself in obtaining a view of the infundibula throughout their whole extent, which had not been possible to him before with simple rhinoscopy; 2. in those cases where rhinoscopy can not be accomplished without the aid of instruments; 3. in various rhinoscopic operations. When the palate is drawn forward by means of the hook, it is easy to introduce the snare, under an illumination, for the removal of tumors in the naso-pharyngeal space, to place the snare around any particular tumor and cut it off. Whilst the instrument is in place the patient must refrain from swallowing; and since this can not be done for any considerable length of time, the instrument should not be allowed to remain in long at a time, and when a tumor is removed it should be withdrawn in order to give the patient an opportunity to swallow, after which it can be replaced for further work.

Discussion: FRÄNKEL said that it was important to reduce as much as possible the number of those cases in which rhinoscopy could not be successful, and was of the opinion that after the employment of Hartmann's instrument there would yet remain a number in which it could not be satisfactorily performed. He, himself, used for bringing forward the palate a waxed string introduced through the nose, as had been recommended by Störk some time before.

GOTTSTEIN had not tried the waxed string. BRESGEN mentioned that Störk had again returned to the employment of the waxed string. BRESGEN diminished the irritability of the pharyngeal mucous membrane by pencilings with iodized glycerine, gradually increasing the strength of the solution. In order to

accustom the parts to the irritation SCHALLE recommends the patient to stand before a mirror and, depressing the tongue deeply, to tickle the pharynx with a feather. In the course of three or four weeks rhinoscopy can be accomplished without any difficulty. FRÄNKEL repeated that he had frequently used the waxed string to bring forward the palate with good results.

4. HARTMANN, Dr., (Berlin.) *On Deaf-Mute Statistics.*

The object of deaf-mute statistics is, in the first place, to determine the frequency of the defect, and in the second place to come to more just conclusions as regards its nature and course. The first could be determined by a proper census.

Since the foundation of the empire there has been no general statistics regarding deaf-mutes in Germany; in Würtemberg there has been no enumeration since 1861, and in some of the smaller states there has been none at all. The nature and cause of the defect must be arrived at by the collection of special statistics. The most extensive special deaf-mute statistics are those collected by the census commission in Ireland in 1861. The speaker then enumerated many points which were in such remarkable opposition to other statistics that the results of these must be gravely doubted. It is for other reasons highly important that the filling out of the necessary inquiry-papers be done by experts—that is, by physicians. We have already two very exact statistics gathered by physicians; one of the district of Cologne, collected by the conjoint action of the physicians of the district; the other of the district of Magdeburg, collected by the head-physician of the district, Wilhelmi. Though the results of these statistics are extremely interesting, the number of deaf-mutes embraced in them is not sufficiently large to definitely settle all disputed points, and it is very desirable to obtain yet further statistics in order to clear up the still doubtful points.

It is of especial importance in these statistics to discover the number of deaf-mutes who have arrived at the age of man and womanhood who have received no instruction, in order that proper steps be taken to give to these unfortunates, by means of the proper deaf-mute instruction, an existence worthy of human beings. According to the latest statistics, the number of non-educated deaf-mutes in Prussia and Bavaria is yet considerable.

The speaker was of the opinion that the next census-taking would offer a good opportunity to collect special deaf-mute statis-

tics. The inquiry-papers must be filled out by the physicians. Since there is in Germany one physician to about every 3,000 inhabitants, and about two to three deaf-mutes to the same number of inhabitants, the amount of labor devolving on each physician would be very small, and such as he would certainly willingly give in the interest of the subject.

FOURTH SESSION.—President : Dr. B. FRÄNKEL.

At the conclusion of his communication at the last session, Dr. HARTMANN submitted the proposition, that the Section express its desire that an enumeration of the deaf mutes in the Empire be taken at the next census on December 1, 1880. The proposition was agreed to unanimously.*

I. GOTTSSTEIN : *On the complex of symptoms known as Ménière's Disease.*

In the opinion of the speaker we had no right to speak of a "Ménière's disease," because very various morbid conditions can bring about impaired hearing and loss of equilibrium. Neither have we a right to accept the term *vertigo ab aure laesa* of the neuro-pathologists (Charcot), because it remains to be shown, for a number of cases, whether the loss of equilibrium has its origin in the ear or brain. We can therefore only speak of a Ménière's complex of symptoms. It is certainly true, that, as a consequence of disease in the conducting apparatus vertigo may arise, and in such cases the only explanation is that the intra-labyrinthine pressure has called it forth.

In regard to settling the question as to whether the semi-circular canals are to be held directly accountable for the loss of equilibrium, or whether, in some way, the central organ is not affected by sympathy, such observations are not of much value. We can expect elucidation from those observations only, in which we can exclude with positiveness, disease in the conducting apparatus as a cause of the symptoms, and there remains to us only the acceptance of an affection of the acusticus at its central origin, along its course, or at its terminal expansion. The speaker distinguishes two forms of this affection, the apoplectic and inflammatory, which he accurately described. He has found that the symptoms do not agree with those obtained from experiments on animals. *In-*

* This resolution was transmitted to the Statistical Bureau of the Empire.

voluntary movements or faulty positions of the head never occur as after artificial section of the semicircular canals. In a number of cases observed by GOTTSTEIN there were pronounced cerebral manifestations, loss of memory, aphasia, eye trouble, and complete destruction of the hearing power on both sides. Unfortunately the majority of cases of the inflammatory form come under observation after the process has ended. In the opinion of the speaker the question as to whether or not we have in these cases to do with a labyrinth disease is yet an open one. This communication will appear in detail in the present volume of these ARCHIVES.

Discussion: Moos had observed many cases of Ménières complex of symptoms, in which the symptoms led to the belief of disease in the brain. As an example he related the following case:

At the beginning of August, 1878, a patient 59 years old, from the north of Germany, consulted him, while on a homeward journey from Wildbad. Ten months previously the patient was suddenly seized with severe pain in region of the right trigeminus (forehead, temple, and parietal region). There was, moreover, tinnitus on the right side, a high degree of deafness, vertigo and vomiting, and pain along the whole course of the vertebral column; twenty-four hours later there was facial paralysis on the right side, which was still present at the time of the consultation, and on which Wildbad exercised no influence. All the other painful symptoms, however, had disappeared. Hearing on the left side was normal. On the right there was almost perfect deafness, and constant subjective noises. Right pupil dilated. In this case the Ménières complex of symptoms was associated with a lesion in the region of the medulla oblongata.

As an instance of how trivial causes can sometimes produce Ménières complex of symptoms, Moos related the following case: A peasant was sent to the ear clinic from the medical clinic with the diagnosis "Ménière's disease." After the removal of a plug of wadding from the right ear, the vertigo, deafness, tinnitus and vomiting disappeared entirely.

KUHN had observed cases in which the symptoms were one-sided, and is of the opinion that in such cases, as a rule, there is trouble in the labyrinth, and that there is no disease in the cerebrum. When syphilis is present, KUHN has seen improvement set in during treatment.

GOTTSTEIN did not dispute that the Ménière complex of

symptoms was often found in one-sided affection of the middle ear, but thought that in the so-called neuropathic form, there was absolute deafness in both ears.

HARTMANN had observed a case in which the symptoms in the apoplectic form were limited to one side. At the same time there was found a blood-blister under the epidermis of the outer meatus, the middle ear being normal. He thought it very probable that rupture of a vessel had taken place in the labyrinth, similar to that in the outer ear. In a syphilitic patient HARTMANN saw Ménière's symptoms as well as the deafness disappear under the internal use of iodide of potassium.

2. HARTMANN, Dr., (Berlin), *On Cleansing the Tympanic Cavity and its Sinuosities.*

The speaker uses for cleansing the tympanic cavity a tube of German silver, the end of which is introduced into the tympanum itself. He has used this method of treatment in many cases and he is convinced that in the treatment of long-standing otorrhœa it can not well be dispensed with. The straight tube, about 2 mm. thick, is bent at right angles at the end designed to be introduced into the tympanic cavity, the bent portion being from 1 to 2 mm. long. The outer end is bent at an obtuse angle in an opposite direction, with a pear-shaped enlargement over which is to be fitted a thin rubber tube, which is to be fastened to the nozzle of the syringe. The tube is to be introduced under illumination through the speculum and held in position with one hand while the other manipulates the syringe. It is requisite, in using the instrument to introduce the tube without injury to the neighboring parts, and to hold it firmly in its place during the syringing. The syringe should be emptied slowly at first, but afterward the stream into the tympanum can be made stronger. It frequently happens that considerable masses of thickened secretion can be removed in this manner from the drum cavity, especially in cases where the exit of the secretion is hindered. Three preparations were exhibited, in two of which a small perforation of the M. T. and in the third a polypus, had been the cause of retention of the secretion. As a consequence of this, there had been caries of the roof of the drum cavity and formation of abscess in the temporal lobe of the brain. In the opinion of the speaker the unfortunate issue of these cases could have been prevented by the timely employment of the tympanic tube.

In a patient of the speaker's, there was found on the anterior upper edge of the M. T. an opening scarcely large enough to allow the passage of the tympanic tube. The rest of the M. T. and the bones were attached to the inner tympanic walls. Cleansing through this small opening removed not only a careous mass from the tympanic cavity, but also a small polypus which in all probability had its seat in the upper portion of the drum cavity and which was loosened and brought away by the current of water. After the cleansing the symptoms of vertigo, stupor and headache, which had been present before, disappeared.

Discussion:—SCHALLE had used for this purpose his exudation suction instrument. With this, masses of secretion had been removed which had collected behind a swelling in the external meatus and given rise to threatening symptoms. MOOS asked whether the speaker had ever observed vertiginous symptoms in these experiments. HARTMANN had often seen them supervene, and advised in such cases to proceed very carefully and employ only a weak stream of fluid.

LIST OF MEMBERS PRESENT.

Dr. ADAE, Eslingen ; Dr. BEHRENS, Manchester ; Dr. BRESGEN, Frankfort on-the-Main ; Dr. B. FRÄNKEL, Berlin ; Dr. FITZGERALD, Dublin ; Dr. L. GERLACH, Erlangen ; Dr. J. GOTTSTEIN, Breslau ; Dr. HAPPE, Hamburg ; Dr. HARTMANN, Berlin ; Dr. HEDINGER, Stuttgart ; Dr. JESSEN, Baden-Baden and Mentone ; Dr. JURASZ, Heidelberg ; Dr. KUHN, Strasburg ; Dr. LOMMEL, Hamburg ; Prof. MOOS, Heidelberg ; Dr. NOLL, Hanau ; Dr. A. PAGENSTECHER, Weisbaden ; Dr. PEPPMÜLLER, Halle, *a. d. S.* ; Dr. REHMANN, Bruchsal-Langenbücken ; Dr. RUFF, Stuttgart ; Dr. R. SCHALLE, Hamburg ; Dr. SELIGMANN, Carlsruhe ; Dr. SENFF, Baden-Baden ; Dr. STIMMEL, Leipsig ; Dr. WARSCHAUER, Krakaw ; Dr. O. WOLF, Frankfort on-the-Main.

CLINICAL CONTRIBUTIONS TO OTOLOGY.

BY

D. B. ST. JOHN ROOSA, M.D.,

AND

EDWARD T. ELY, M.D.

CASE I.—*Loss of hearing from a kiss upon the ear.*

Mrs. H., æt 42, seen through the kindness of Dr. O. B. Douglas. Last winter (1878), her husband came up behind her as she sat reading and kissed her suddenly upon the right ear, taking her completely by surprise. She suffered a great shock and had a roaring in the ear for some time. The incident made her very "nervous" for two or three weeks afterwards. During the past summer she was told by her relatives that she was becoming deaf on the right side. She paid no attention to it until six weeks ago, when she tried her right ear with her watch and found she could not hear it. She gives satisfactory evidence of having heard a whisper well with the right ear during last winter and spring. Has had occasional tinnitus during the past few months after taking cold. Enjoyed music very much formerly, but does not now. The piano-practice of the children at home annoys her. Whistling is particularly disagreeable. All noises disturb her somewhat, so that she has "felt afraid that she was becoming nervous." General health is good. Menstruates regularly. No cardiac trouble detected. Father died of paralysis.

H. D., R. $\frac{P}{40}$. L. $\frac{40}{40}$.

Tuning-fork on teeth or vertex seemed louder in the left ear. Is slightly intensified in right by plugging, but much more in left. Aerial better than bone-conduction on each side.

The drumheads are about alike and show nothing to account for deafness. Air enters the right drum by both catheter and Politzer's method, but does not alter hearing. All notes of the piano are heard, but she says they do not sound "clear," even

with both ears open. Dr. Douglas examined the naso-pharyngeal space and the mouths of the Eustachian tubes and found nothing abnormal.

This seemed to be a case of deafness from affection of the labyrinth, with no apparent cause except the kiss upon the ear. The concussion from the kiss, may have caused the loss of hearing at once: or, as seems more likely, it may have produced changes in the labyrinth, which, in combination with the general nervous shock, served as a foundation for a gradual loss of hearing subsequently,—as, for instance, by some atrophic process.

Mr. Hinton was inclined to think that in all instances of loss of hearing, apparently from slight causes, it might be found that some previous source of injury to the ear had existed. He quotes some cases to illustrate that view. He speaks of a concussion sometimes jarring the labyrinth, not into complete paralysis, but into a state of extreme liability to this condition.*

CASE 2.—Alarming syncope after cleansing ear.

Mr. G., æt. 40; lawyer. Consulted us on February 1, 1879, for a chronic suppuration of the right middle ear, which he had allowed to remain neglected for a long time.

The hearing was: *R.* $\frac{5}{48}$, *L.* $\frac{48}{48}$.

Tuning-fork on teeth heard chiefly in *R. E.*

The ear was syringed with warm water and then cleaned with cotton on cotton-holder, after which the patient complained of feeling faint. He immediately lay down upon the sofa but he did not recover from the syncope as it was expected he would do. He became comatose, and his countenance was livid. His respirations sank to six in the minute and were stertorous. The heart-beat was very feeble and no pulse could be felt at the wrist. He looked as if he were certainly dying. His clothes were loosened as soon as possible, and, by the time this had been done, he opened his eyes and spoke. After this, ammonia was applied to his nostrils and given internally with sherry wine. Electricity was applied also, by Dr. Rockwell, who, together with Drs. Sayre, Bache, Emmet, and Bull, rendered kind assistance. For some time the patient's mind was not perfectly clear, his color was livid and his pulse very feeble; but finally he became better. The accident happened at 1 P.M., and he remained upon the sofa until 2.45 P.M.

* *Questions of Aural Surgery*, p. 268.

He then went home, complaining of chilly sensations. He did not look as well, however, as he did before the attack.

We had never before seen any such serious symptoms from cleansing a tympanic cavity and were at a loss to account for them. The manipulations were all made with the utmost gentleness. Mr. G. himself said that nothing was done for his ear which caused the slightest pain or discomfort; and he attributed the fainting entirely to "mental influence,"—a sort of dread that he *would* possibly be hurt. He had never fainted but once in his life before, and that was after hearing a friend tell of a surgical operation. He had lately been subjected to overwork and anxiety; he had a sallow complexion and gave some symptoms of organic heart disease. Otherwise, he looked like a strong man.

Mr. G. came after the close of office-hours when there was not sufficient time for more than a superficial examination of his case. His history, therefore, was not recorded as fully as it would have been otherwise. The fainting occurred before the condition of his middle ear had been determined. After the attack it was not considered proper to subject him to any further examination, and he has never been seen again. His case is reported simply to show what serious consequences may arise from cleansing an ear.

CASE 3.—*Serious syncope from inflation of middle ears by Politzer's method.*

Miss P., æt 19, came June 24, 1879, complaining of deafness and "confused feelings" in the right ear. There was a history of pain and discharge in that ear after scarlet fever, at the age of $2\frac{1}{2}$ years.

The hearing was: *R.* $\frac{0}{48}$, *L.* $\frac{48}{48}$. Tuning-fork on teeth heard better in left ear. Right drumhead cicatricial and hyperæmic. Left sunken, no light-spot. After inflation by Politzer's method, this patient had a serious attack of syncope, from which she recovered very slowly. At her next visit she fainted again after a most gentle inflation through Hinton's tube. The catheter was not used at either visit.

The improvement in the hearing and in the sensations of the right ear from inflation made her "feel strange," and this may have had something to do with the fainting. She had a very nervous temperament, and was anæmic. She gave the impression of being too tightly laced, and of being improperly managed generally. Dizziness after inflation is not uncommon: syncope from

inflation by Politzer's method, properly performed, has never before been seen in the writer's experience.

CASE 4.—*Vertigo from singing high notes.*

Miss H., a professional singer, was seen in January, 1879, on account of a suppuration of the right middle ear and a whistling tinnitus, which had begun two months before.

H. D., *R.* $\frac{5}{40}$, *L.* $\frac{40}{40}$.

Tuning-fork on teeth heard best in *R. E.* Right drumhead perforate posteriorly. Left showed a cicatrix (?) in front of malleus.

Vertigo was caused by singing a high note, and sometimes such notes sounded false to her. All notes of a piano were heard correctly.

CASE 5.—*Mastoid abscess without any evidences of disease of the external or middle ear.*

Wm. H., æt 6, came on September 28, 1876, complaining of pain in the region of the ear. There was redness, swelling and tenderness over the mastoid process. On September 30th an incision was made and a considerable quantity of pus evacuated. This was followed by recovery. No caries were detected. There was not the slightest evidence of any congestion or inflammation of the external auditory canal or middle ear.

This case is somewhat similar to those reported by Dr. D. Webster, in the *ARCHIVES OF OTOLGY*, vol. viii, No. 1.

Such cases are rare.

CASE 6.—*Mental depression from impacted wax.*

Mr. T., æt 18, has been seen at intervals for several years on account of a chronic suppuration in the right middle ear. The left ear was normal. On May 15, 1879, the right ear was in very good condition; the hearing was $\frac{1}{10}$, and there was no discharge. Patient came again on September 24th, complaining that since June he had suffered from "a feeling of heaviness in his head." Was "unable to concentrate his mind on anything for more than a few minutes." Felt as if he must give up his studies (in which he was very much interested), and wished to know whether he must leave college. Thought his deafness had increased, but had no pain, tinnitus or discharge. The patient was sullen and very

despondent. Otherwise his health seemed to be excellent. He was very reticent by nature.

H. D., R. $\frac{5}{16}$. External auditory canal filled with hard wax. After removing the wax, the hearing became $\frac{1}{16}$, and the tympanic cavity looked as it had at former visits; there was no discharge.

The patient obtained speedy relief, and in a few days reported the discomfort about his head gone. He was then as cheerful as usual.

This case was interesting, as illustrating the disturbing influence of impacted wax, even with an entire absence of tinnitus.

Mucus in the tympanum.

Within the past few months a number of cases of chronic suppuration of the middle ear have been seen, in which there were large accumulations of mucus in the tympanic cavity. It is not meant that there was a large admixture of mucus with an ordinary purulent discharge, but that the tympanum (and probably the mastoid cells) was filled with such masses of tenacious, glue-like material as are sometimes found with an imperforate drumhead. In some of the cases a recent purulent discharge seemed to have been replaced by the secretion of mucus; in other cases there had been no discharge of pus for a long time. The symptoms were the familiar ones of oppression about the head, of feeling of *pressure*, of embarrassing fluctuations in hearing power, etc. The usual difficulty was found in removing the mucus thoroughly, and it re-formed in each case several successive times. This condition is not common in cases of chronic suppuration, in the reporter's experience. Other practitioners, however, may have seen it often. Sea-bathing seemed to have a causative influence in two of the cases alluded to above.

An ordinary lachrymal syringe, with a long flexible nozzle, has been found very efficient for sucking out mucus from the drum, especially after a paracentesis.

CHOLESTEATOMA OF THE RIGHT TEMPORAL BONE,
PERFORATING INTO THE REGION OF THE SEMI-
CIRCULAR CANALS.—CEREBRAL ABSCESS.—AU-
Topsy.

By H. STEINBRÜGGE, OF HEIDELBERG.

Translated by ISIDOR FURST, of New York.

July 1, 1878, J. E., teacher, æt. 58, from Ilmspan, was sent from Prof. Erb's wards of the Heidelberg Academic Hospital into Prof. Moos' clinic for examination, on account of an ear affection on his right side. Patient had suffered for two weeks from vertigo, pain in the right parietal region, and neuralgic symptoms in the region of the third branch of the right trigminus. Simultaneously with his admission to the hospital, inability to pass urine spontaneously set in, so that the catheter had to be resorted to.

The anamnesis showed that the patient's father had died from marasmus at the age of 51. The mother was healthy. He himself is the father of three healthy children. In his fourth year, his left eye was injured; a staphyloma formed, and in his eighteenth year the eye was enucleated, as it caused continual pain. He remained in good health up to seven years ago, when a purulent otorrhœa set in on the right side. Examination proved the presence of a polypus which was operated on by Prof. Simon, of Heidelberg. After that, the ear is said to have been healthy, and the hearing good. Soon after, in consequence of a violent cold, he was attacked with articular rheumatism which confined him to bed for six weeks, and later required a course of treatment at Baden-Baden, at the end of which he again felt perfectly well. Only two weeks ago, together with the above-mentioned affections, pain in the right ear, and purulent, offensive discharge from it are said to have recurred.

Patient is tall and of strong frame, but of cachectic appearance; he answers questions slowly and with indifference, but his mind

is not otherwise affected. Paralytic symptoms in the muscles of the face or extremities are not noticeable. His acuteness of hearing is sufficient for ordinary conversation.* Examination of the right ear shows the meatus in its depth filled with whitish-yellow masses. These having been removed by syringing and the forceps, a small whitish-gray thickened remnant of the membrana tympani becomes visible anteriorly, its posterior section being completely destroyed, exposing a considerable depression which extends into the wall of the posterior meatus. This depression is filled with similar white, lamellated waxy masses a part of which is removed from the region of the antrum mastoideum with forceps. After repeated cleansing, the posterior portion of the labyrinth wall becomes visible as a smooth surface covered with gray mucous membrane, while in the space posteriorly and above, still other whitish masses are in sight. No trace of the ossicles. The region of the mastoid process is neither injected nor swollen, and not painful on percussion. Patient states that his head feels easier after the cleansing of the ear; lukewarm ear-baths are recommended for softening the remaining elements; patient returns to Erb's wards with the direction to present himself again in a few days.

Meanwhile, however, his condition grew so much worse that, on July 3d, he was transferred to Dr. Friedreich's wards, where he presented the following symptoms.† The left arm and left leg are partially paralyzed. The fingers can be moved, but their force in pressing compared with the right side, is materially diminished. The sensibility in the left upper extremity is reduced; but the statements of the patient are not quite exact, owing to the impaired sensorium. The left leg is raised from the couch with uncertainty and slowly; its sensibility and perception of pain are nearly absent. The left angle of the mouth droops, the tongue is projected to the left. Sensibility in the left half of the face is diminished. Pain in the right half of the head. Vision in the remaining right eye is impaired. Appetite diminished within the last two weeks; no alvine evacuation in two days. Urine drawn with the catheter. Spec. grav. 1026. Thoracic and pelvic viscera appear normal on examination. Minimum temp., 37.4; maximum 38.8. Pulse, 80. Ordered ice-cap to the head; Vienna laxative water.

July 4th.—Patient has been restless through the night, talking

* Obviously the patient heard only with the sound ear. Compare the autopsy.

† For the clinical notes, a synopsis of which I reproduce, I am indebted to Dr. Friedreich; for those of the autopsy, to Prof. J. Arnold.

a great deal. Three liquid stools. Paralytic symptoms continued. Left leg somewhat contracted. Patient is somnolent. Respiration labored and stertorous. Minimum temp., 37.6; maximum, 38.9. Pulse, 72.

July 5th.—Restless night. 6 A.M. Left extremities flexed; can be stretched only by using force; sterno-cleido-mastoid muscles tense. 8 A.M. Trismus, rigor of nucha. The urine drawn by the catheter contains a quantity of albumen; spec. grav. 1026. Pupils moderately dilated; no reaction on touching the cornea. Respiration irregular. Coma; death at 10.30 A.M.

Autopsy.—Skull-cap thin. On its interior surface occasional deposits of spongy osseous tissue. Much fluid blood in the longitudinal sinus. Veins of the pia mater filled to the utmost. The convolutions of the brain appear greatly flattened. The right temporal lobe is adherent to the petrous bone, and on separating the brain, a whitish, iridescent mass is exposed at the height of the petrous bone. All the sinuses contain fluid blood; their walls are not altered. The dura mater, through the whole extent of the right temporal fossa, is thickened and covered with gray spots. The pia mater, otherwise infiltrated with serum, reddened, and opacified, shows at a corresponding place a greenish discoloration, as does the brain substance. The latter shows distinct fluctuation on palpation. Both lateral ventricles are filled with copious slightly turbid, serous fluid. The ependyma on the left side is clear and translucent, on the right anteriorly discolored greenish-gray, but in the posterior horn completely macerated and easily torn, as in the adjoining brain substance.

In the right temporal lobe, corresponding to the greenish discoloration of the pia mater, there is a cavity, the size of an apple, filled with offensive pus, and separated from the neighboring parts by a layer of connective tissue. The surrounding brain substance is sclerosed, interspersed with small hemorrhages and shows slight gray discoloration. On separating the brain, the abscess is opened inferiorly; superiorly, as above mentioned, it closely approaches the lateral ventricle. The left optic nerve is atrophied.

The apices of the lungs are adherent, the right is somewhat condensed and shows cicatricial contraction. The remaining organs do not exhibit any material alterations.

The right petrous bone, which is removed from the cadaver, shows on its anterior surface a perforation through the bone and dura mater, measuring 12 mm. in its longitudinal, and 8 mm. in its

transverse diameter ; it commences immediately outward from the eminentia arcuata and is filled with white, somewhat convex, prominent cholesteatomatous masses. In the circumference of the perforation the dura mater is materially thickened ; after detaching it, the pyramidal bone, in a zone of 4-6 *mm.* around the perforation, appears rough and carious, although still hard. This affection of the bone is limited posteriorly by the upper angle of the petrous bone ; internally by the sagittal semicircular canal which is perforated ; anteriorly by an imaginary line extending in the direction of the furrow for the nervus petrosus superficialis major outward and backward, so that the roof of the tympanic cavity remains intact ; and, finally, externally by a curve crossing the base of the pyramid transversely, at a distance of about 18 *mm.* from the sagittal semicircular canal. The external layer of the superior petrous sinus, under which was the posterior limit of the affected bone, was greatly thickened ; but the lumen of the sinus was free. The internal auditory meatus with the two nerves, the mouth of the vestibular aqueduct, and the roof of the vestibule, unchanged. At the posterior wall of the pyramid, between the mouth of the vestibular aqueduct and the anterior margin of the sigmoid fossa, there is a circular depression, 3 *mm.* in diameter, with smooth borders, but a rough fundus, to which adhered a corresponding thickening of the dura mater.

On removing the anterior wall of the auditory meatus, the status of the membrana tympani and drum cavity seen during life is confirmed. There is also noted, at the inferior wall of the meatus, an exostotic, longitudinal prominence, which extends 14 *mm.* from the remnant of the membrana tympani. The three ossicles are absent ; the labyrinth wall is changed to a slightly concave surface covered with thickened, gray mucous membrane ; the two fenestræ and the tympanic sinus are no longer visible. The tympanic orifice of the tube is obstructed by thickened mucous membrane, so that a dissecting needle introduced from the cartilaginous portion can barely pass. The posterior segment of the tympanic ring is destroyed. The drum, the mastoid antrum, and the loss of substance in the posterior wall of the auditory meatus form one large cavity. A cut with a saw was directed vertically to the longitudinal axis of the pyramid, so as to cross the outer portion of the osseous meatus, the interior third of the mastoid process, and the base of the pyramid. The cavity caused by the destruction of tissue, and to a great extent filled with concentric

layers of cholesteatomatous masses, was thus divided into halves, the exterior of which extended into the mastoid apophysis, where it reached a height of $1\frac{1}{2}$ cm. and a breadth of 8 mm. Nothing could be seen of the cellular spaces; the remaining osseous shell was sclerosed. The interior half of the specimen presented a similar aspect. Here, too, the bone limiting the cavity was sclerosed; but interiorly, in the longitudinal direction of the pyramid, the destruction in the region of the frontal and horizontal semi-circular canals extended further, communicating with the perforation described above. A closer examination of the semi-circular canals, the vestibule, the cochlea (which apparently was intact), and the facial nerve, had to be abandoned in order to preserve the specimen. The examination of particles of the cholesteatomatous mass, taken from various places, showed everywhere the same well-known composition: necrosed epidermic cells, some with, others without nuclei; between them irregular, round-cornered lustrous corpuscles, mentioned by Virchow and Lucæ, which might be taken for degenerated nuclei derived from the cells. Small plates of cholesterine were seen in some places.

A small piece of thickened mucous membrane, taken from the upper part of the labyrinth wall, was then embedded in liver and divided into vertical sections. On microscopic examination, a complete epidermoid metamorphosis of the mucous surface was discovered. Under a thin layer of yellowish epidermis, there was a layer of Malpighi's cells, partly extending into the mucous membrane in undulating lines, partly investing papillary prominences of the latter. One of these undulating prominences extended 18 mm. downward. The mucous membrane was itself infiltrated with numerous round cells, and had wide vessels. While its tissue was quickly stained by iodine, the cells of Malpighi and the epidermis remained uncolored.

This epidermoid metamorphosis of the epithelium of the mucous membrane, discovered and first described by Lucæ in granulations removed from the roof of the mastoid antrum in a case of cholesteatoma of the petrous bone, and, moreover, demonstrated likewise by Wendt and Schwartze in the non-granulating mucous membrane of the tympanic cavity as the basis of the cholesteatoma, was also in our case discovered by microscopic examination. The case doubtlessly belonged to the category of those in which,

during a chronic purulent otitis media, the normal epithelium of the mucous membrane of the drum cavity, the mastoid antrum, and the mastoid cells undergo the above-mentioned metamorphosis; the stagnating masses of epidermis are constantly increased by new depositions, and exert, partly by pressure, partly by their products of decomposition, a continuous inflammatory irritation, perhaps also a direct chemical influence, on the surrounding bone. For we have to deal, in *these* cases of so-called pearly tumor, only with "dead material," not with living cells. Then a partly sclerosing, partly rarefying otitis occurs, and, under favorable conditions, the bone is perforated. The fibrous structure of the dura mater seems capable of arresting the perforation for a time, as indicated by the lower thickened layer of the superior petrosal sinus, and the thickened zone of the dura mater in the surroundings of the perforation.

As the cartilaginous part of the auditory meatus, especially at its interior wall, appeared thickened, cross-sections of it were subjected to microscopic examination. The perichondrium appeared proliferated in spots; the fibres of the cartilage were denser and more abundant than in normal preparations; the cells and their capsules were smaller. In some places calcareous deposits were found. The lime was deposited partly in the cells, partly in the intercellular substance; the latter appeared bright, granular, and did not imbibe carmine. This last condition furnished an additional demonstration of the calcification of the reticulated fibrous cartilage which is thought to be rare.

It might be mentioned as of clinical importance, that both the perforation of the petrous bone and the cerebral abscess had probably existed for some time before the patient sought medical advice. The incapsulation of the abscess by connective tissue, furnished the proof for this assertion. Equally evident in this case was also the inefficacy of an operative interference at the time when the patient sought relief. It would have been easy to penetrate through the opening in the posterior wall of the auditory meatus with curved probes or spoons, remove the masses of cholesteatoma, and enter the destroyed labyrinth, but this

would probably have hastened the fatal termination. Therefore, this case again teaches us how carefully, when suspecting cholesteatoma of the petrous bone, we ought to enquire into the duration of the affection, the occurrence of cerebral symptoms and the temperature of the patient. We should not treat such cases as out-door patients, and be on our guard in framing the prognosis. The fact that the destruction within the bone may have progressed much further than the symptoms seem to indicate, is of particular importance when it is necessary to open the bone, either from the mastoid process or the posterior wall of the auditory meatus.

EXTIRPATION OF THE ENTIRE MALLEUS, TO-
GETHER WITH A POLYPUS SPRINGING
FROM ITS MANUBRIUM.

BY S. MOOS, OF HEIDELBERG.

Translated by ISIDOR FURST, of New York.

IN his recently published article "On the Operative Treatment of Aural Polypi," *Wiener Med. Wochenschr.*, 1879, Nos. 16, *et seq.*, Adam Politzer says that, in cases in which the polypus springs from the membrana tympani or the drum cavity, the fact ought to be borne in mind that such proliferations are not infrequently intimately connected with the ossicles; lest through the employment of a faulty operative procedure, one of the ossicles be extracted together with the polypus.

In general, everybody will coincide with this cautious and conscientious writer. However, the extraction of one of the ossicles *together with* the polypus cannot always be avoided, whether the connection of the neoplasm with any one of them be diagnosticated before the operation or not. It might even be possible that a vital indication would be fulfilled by the removal of the growth *together with* the malleus.

For instance, I have described * a case of purulent otitis media with central perforation of the membrana tympani; stagnation of the pus in the middle ear, owing to complete occlusion of the perforation by a polypus with a long pedicle, and the manubrium adherent to it and detached from the membrana tympani; inspissation of the secretion in the

* Contributions to the Pathology and Path. Anat., etc. Second paper. *Arch. Ophthalm. and Otol.*, vol. vii, p. 465.

drum cavity and the mastoid cells; phlebitis and thrombosis of the sinus transversus dexter, the vena emissaria Santoriniana, and the vena jug. int. dextra; metastatic infarctions of the lung; fibrino-purulent sacculated pleuritis and pneumonia dextra. In the epicrisis of this case I have shown that, in a certain stage of the affection, the life of the patient might have been saved by the removal of the neoplasm together with the malleus; and from the case reported below, in which a more definite diagnosis could only be made *after* the operation, it will be seen that the extirpation of the neoplasm simultaneously with the malleus cannot always be avoided, even if a positive diagnosis could be made *before* the operation; further, that this operation is harmless in every way, and that the utility of the retained, isolated malleus appears very questionable, even supposing that the neoplasm could be detached *secundum artem* from the malleus remaining behind.

Jacob Hemy, æt. 5½, was brought to the Heidelberg ear clinic by his mother on January 23, 1879.

Anamnesis.—Patient had been affected, in September, 1878, with pharyngeal diphtheritis. In its course, according to the description, he was attacked with right-sided acute purulent otitis media, followed by purulent, now and then bloody discharges.

Status præsens.—The right external auditory meatus completely filled with a rather dark-red tumor, easily circumscribed by the probe and freely movable. The probe encountered no ossicle either in or upon the tumor,

Jan. 30th.—Operation with the Wilde-Blake snare under chloroform. The wire is introduced between the tumor and the inferior wall of the auditory meatus, and during its gradual tightening is pushed inward as far as possible, and the neoplasm then extracted. Profuse hemorrhage. The tumor, which appears pale-red after the operation, encloses the entire malleus, the head of which is denuded of its mucous membrane and its periosteum. The tumor is 2.7 cm. long, 4.7 mm. thick. It springs from the entire circumference of the manubrium; its connection therewith toward the external meatus is somewhat more intimate than toward the tympanic cavity. Anteriorly the tumor covers the ossicle up to 4 mm., posteriorly up to 3 mm. from its upper head. The osseous tissue

of the whole malleus seems unchanged. The tumor in its lower third shows a small pigmented portion, but was not microscopically examined in order to preserve the rare specimen. A careful microscopical examination demonstrated, however, that it originated on the medial side of the mucous membrane of the handle.

After the operation, a second tumor presented itself in the region of the posterior-upper quadrant of the membrana tympani. It sprang, as was subsequently proved, from the inner wall of the drum cavity corresponding to that quadrant. The membrana tympani had a perforation, the size of a pin's head, in front of the region of the end of the handle. The remainder of the thus twice perforated membrane was grayish-red, adhering with its central part to the promontory, which, opposite the more centrally located perforation, had a granulated appearance. The long process of the incus was not visible.

On January 31st a portion of the second tumor was removed with a toothed polypus forceps. February 4th, lead acetate. February 6th to 11th, slight secretion. February 13th and 18th, external meatus swollen; lukewarm ear-baths. February 22d to March 4th, lead acetate; secretion diminished; treatment continued. March 11th to 25th, alum. The granulations in the posterior upper quadrant of the drum cavity has increased; cauterization with lapis mitigatus, which is three times repeated till April 3d. April 5th to 22d, home treatment with salicylic acid. Treatment with lead acetate was continued till June 10th, granulations being removed with lapis mitig. or galvano-cautery.

June 11th.—Cure. The central part of the membrana tympani is united with the wall of the labyrinth. Its anterior half is gray, slightly glossy. No perforation visible. In place of the manubrium may be seen an exceedingly narrow, whitish ridge, closely resembling the former; the region of the short process, too, is marked by a small prominence. Below and anteriorly to the white ridge, a yellowish-white rounded depression is visible. The cicatrized posterior upper quadrant is still covered with some dried secretion.

Hearing distance for Politzer's acoumeter, 0.03. Speech understood at a distance of two metres. All tuning-forks are better perceived on the right side.

Pathogenetically we might assume the following conditions:

The pharyngeal diphtheritis from which patient had suffered in September, 1878, extended through the Eustachian tube to the middle ear, producing violent inflammation of the drum cavity and membrana tympani; this again was so intense as to more or less rapidly loosen and finally dislocate the manubrium from its well-known intimate and peculiar relation with the membrana tympani, and the head of the malleus from its ligamentous connections with the walls of the drum cavity. During this morbid process a tumor developed from the manubrium. Its greatest enlargement, however, in view of the natural size of the entire malleus and the above described dimensions of the tumor, could only have taken place after the malleus with its tumor had been dislocated toward the external meatus, the former perhaps still in a slight connection with the wall of the drum cavity, which was severed during the operation. Possibly, at that time, the two perforations formed one larger one.

During the examination preceding the operation, I had found no indication of a connection of the tumor with the manubrium mallei. Even if I had recognized the exact state of affairs, I should not have acted differently, for the simple reason that I believe it to be impossible *secundum artem* to detect a tumor connected with the manubrium in the manner stated above. Or supposing the problem were solved in a like case, of what use would be the retained malleus to the patient as long as the incus was wanting? Its cuticular layer, the main carrier of the vessels of the membrana tympani, which plays so important a part in the cicatrization of defects of the membrane, conditions which actually occurred in our case, was obviously left behind after it had been detached from the membrana tympani. Besides, this vascular plexus does not exclusively cause the cicatrization of the defects of the membrana tympani. At least in the clinic, within the last two years we have observed two cases of total defect, in which the latter closed inside of a year, by means of proliferation of connective tissue in a concentric direction from the very vascular annulus toward the isolated manubrium, which was united with the wall of the labyrinth.

As to the above described appearance of the membrana tympani after the recovery, it was of such a nature that even an experienced examiner would hardly have credited the absence of the manubrium, and would easily have taken the raised line in the cutis for the natural appearances of the membrana tympani, caused by the short process and the manubrium.

SURPRISINGLY INCREASED ACUTENESS OF HEARING FOR LOW TONES IN A CASE OF PARALYSIS OF THE RIGHT FACIAL NERVE.

By S. MOOS, OF HEIDELBERG.

Translated by ISIDOR FURST, of New York.

A. LUCÆ, it is well known, was the first to demonstrate the fact that, in cases of facial paralysis in which the branch supplying the stapedial muscle is implicated, deep tones can be heard at a greater distance than on the sound side.

In the following case I had the opportunity of confirming the correctness of this statement.

November 28, 1875, Dr. G. was sent to me by Prof. Erb, for examination of his organ of hearing. The diagnosis was: "*Paralysis nervi facialis dext. rheumatica, grave form (with degenerative-reaction) and disturbance of taste.*"

The anamnesis proved the existence of the affection for six weeks, it is said, from cold. Musical tones painful; otherwise there were no subjective perceptions in the organ of hearing. On the right half of the face, all the symptoms of a paralysis of the facial nerve. External auditory meatus and membrana tympani on the right side unchanged. Whispered speech heard at 4-5 metres. Bone conduction for low-ticking watch absent, present for loud-ticking one. Increased for tones of tuning-forks.

The hearing distance for the tuning-forks by air-conduction yielded:

On the sound side: C', 3.40 metres; C'', 3; a, 6.80 metres.

" affected side: C', 6.80 metres; C'', 6.80; a, 6.80 metres

For the watch on the sound side: 2.90 metres.

For the watch on the affected side: 0.45 metres.

Hence the acuteness of hearing for deep tones was doubted on the affected side.

Patient did not present himself again either to me or to Prof. Erb, who, however, learned that patient had died in the summer of 1876, at his home, in consequence of infection from a corpse.

In the course of time I again had occasion to examine for acuteness of hearing in another case of grave rheumatic paralysis of the facial; the functional tests yielded the following results:

C' was not heard at all on the affected side, C'' only at one-third the distance of the sound side, and a only at 3 cm.

Besides, bone conduction for the low-ticking watch was absent, but present for the loud-ticking one, and for all the tuning-forks, on the affected side. Distance for speech, 4 metres. Membrana tympani normal. The treatment, until health was restored, lasted a whole year and was directed partly by Prof. Erb, partly by myself. The treatment of the ear consisted of the application of the constant current, which showed the remarkable fact that after every galvanization of the ear by internal arrangement, (*innere Versuchsanordnung*), an improvement for the watch and tuning-forks by air conduction, and for speech, could be demonstrated; while by external arrangement this was the case only after repeated treatment. The latter, however, soon had to take the place of the former, as the patient could not bear the internal arrangement with more than twelve Simens-Halske's elements, on account of the great pain.

A CASE OF LOSS OF TASTE AFTER EXTIRPATION OF
A POLYPUS SPRINGING FROM THE REGION
OF THE STAPES.

By S. MOOS, OF HEIDELBERG.

Translated by ISIDOR FURST, of New York.

Mr. B., from Helsingfors, consulted me on June 22, 1876, for some ear trouble on the right side. The affection had existed for many years, and manifested itself by deafness and discharge. On examination, I found the anterior half of the membrana tympani preserved; the defect in the posterior half was filled with a large spherical, pale-red tumor with narrow pedicle which sprang from the region of the stapes. Incus absent. On June 24th, the tumor was removed by the Wilde-Blake snare. The operation terminated favorably, healing by the end of July; but, on the second day after the operation, symptoms occurred which led me to infer that during its performance a lesion of the chorda tympani had taken place. I therefore sent the patient to Prof. Erb, to whom I am indebted for the following note.

"Diagnosis: *Traumatic paralysis of the chorda tympani dextra.*

"Patient observed the first manifestations of his affection after an operation (extirpation of a polypus in the drum cavity), viz.: a sensation as if the right half of the tongue were numb; in the anterior two-thirds and the edge of the tongue the sense of taste is blunted to a corresponding extent; the sense of touch, however, being rather intensified.

"Once, a profuse secretion of saliva occurred after irritation in the ear. No pain in the tongue, rather a sensation of being scalded.

"Status on July 1, 1876.—Facialis, trigeminus, face, gums, cheek normal. Sensibility at the margin and in the anterior two-thirds of the right half of the tongue distinct, at any rate but slightly altered.

"Tests with needle, camel's-hair brush, pencil, cold and heat, faradic and galvanic currents show: Sensibility on the right side is somewhat blunted and indistinct, left clearer and more definite. Right, on successive impressions, a more intense sensation, but at the same time rather disagreeable, hence slight anæsthesia, coupled with an indication of hyperæsthesia. The reduction of the sensibility on the right side is not considerable; though distinct when compared with the left side. On the other hand, in the places named above a marked reduction of the sense of taste is manifest when tested with sweet, sour, salty and bitter substances and the galvanic current which produce a sensation of touch, but no trace of taste; while in the left half of the tongue the sensation of taste is perceived promptly and distinctly.

"Taste in the posterior half of the tongue alike on both sides. As to the secretion of saliva nothing definite can be learned, owing to unfavorable conditions for examination. Patient has observed nothing like a unilateral alteration.

"In other respects patient is healthy. Even the tongue shows no manner of difference in appearance and quality, no increase of epithelial coating.

"*July 5th.*—Since yesterday considerable improvement has set in. The subjective sensation of the tongue is now normal; the taste, too, is improved. Lately, after the examination, an increased secretion of saliva on the right side remained. The objective examination likewise demonstrates marked improvement. Sweet and sour are now well perceived on the right side, salt pretty well, bitter still rather imperfectly. The galvanic taste on the right, is again present, but still weaker than on the left. The sensibility in both halves of the tongue is now alike; the sensation of being scalded has disappeared. The ear has improved; the secretion has ceased.

"*July 28th.*—No trace of subjective disturbance. Objectively, only sour and salt are still tasted somewhat indistinctly. No paræsthesia, no alteration in the secretion of saliva."

In all probability, the chorda tympani was injured during the passing of the wire-snare over the surface of the tumor and its subsequent tightening. Special treatment for the loss of taste was not instituted; spontaneous cure occurred, and the patient went home in the beginning of August.

In conclusion, I may still remark that the chorda tympani was not visible in any of the repeated examinations.

A CONTRIBUTION TO THE PATHOLOGY OF THE ORGAN OF HEARING.

BY THOMAS R. POOLEY, OF NEW YORK.

THE following cases seem to me worthy of publication, mainly on account of the interest which attaches to the post mortem examinations; but, they are also instructive both from a clinical and practical standpoint.

I very much regret, that my opportunities to observe the two cases in Charity Hospital were not such as to have enabled me to give the clinical histories more in detail. The history of the other case is necessarily very brief, as the patient was only under observation for a few days before his death.

I.

Multiple Exostoses of Skull. Thrombosis of Left Lateral, Inf. Petrosal and Cavernous Sinuses. Acute Catarrhal Pneumonia of Both Lungs.

Minnie Lee, æt. 21, admitted to ward 10, Charity Hospital, January 5, 1877, under Dr. Chamberlain's care, was kindly transferred by him to the Ophthalmic and Aural ward, and thus came under my notice May 10, 1877. She stated that up to five months ago she was entirely well. No definite history of syphilis could be obtained from her, and there was no discoverable trace of a primary lesion. About the time mentioned she complained of great pain, which was accompanied by swelling on the right side of the head. The pain was much more severe towards night. Soon afterwards the left side of the head also became the seat of

swelling and pain. In the course of the next few weeks, in spite of treatment, which mainly consisted in the administration of large doses of iodide of potassium, she became much worse, and her suffering was so great that she had to be kept almost constantly under the influence of morphine. She now began to get deaf, and soon became entirely so, and was for this reason referred to me at the time mentioned.

A careful examination of the ears revealed no abnormality whatever. The membranæ tympanorum were healthy in appearance, and the Eustachian tubes both patent. On account of the condition of the patient—she was entirely bed-ridden and very much emaciated—it was very difficult to make a critical examination of the hearing, but so far as this could be done, she seemed to be absolutely deaf for all sounds by air and bone conduction.

About the end of May, the pain which before was intermittent and greatly worse at night, became continuous. At the same time a slight drooping of the angle of the mouth and upper lid of the left side was observed. Ophthalmoscopic examination revealed marked choked disc of both eyes, there was however, apparently no impairment of sight. June 1st, a severe cough set in, and the patient wasted almost to a skeleton. She finally succumbed July 9th, at 3 P.M., being *entirely conscious* almost to the end.

Autopsy, 23 hours after death, by Dr. W. A. Maxwell, Curator of the Hospital. *Head*.—Scalp normal. Pericranium thickened in patches and adherent, at others of normal appearance and thickness. *Bones*.—Shape of head broadened across parietal region. The whole external surface of the bones covered with exostoses varying in size from a mere point to 2 cm. in diameter, and elevated above the surface of the skull from 2–30 mm. These exostoses although general, were most thickly clustered over the parietal and frontal eminences. Besides the exostoses, in certain patches, the bones showed a superficial loss of substance, as though by a slow caries. A patch in the left half of the occipital bone, just outside the median line, where the bones are very thin and held together by a periosteal-looking membrane. Sutures everywhere loosened; and the parietal, temporal and frontal ones easily separated on attempting to remove the skull. Besides the roughening and

the exostoses noted, the bones of the skull are softened and reddish. Left petrous portion of temporal bone thickened and deformed from exostoses or local inflammation and internally roughened. *Dura mater*.—Adherent to bones, roughened and thickened. The left lateral, inferior petrosal and both cavernous sinuses all completely filled with a firm thrombosis. The clot was prolonged to the right side of the torcular Herophili, decolorized, moderately adherent to the inner wall of the sinus, and at two or three points was softened in the centre. Vessels at the base of the brain normal. *Cranial Nerves*.—The seventh, eighth and sixth nerve appeared softened and flattened at their superficial origins. *Brain*.—Substance normal. *Thorax*.—Old pleuritic adhesions of right side. *Lungs*.—Both lower lobes, and middle one of the right side extending into basis of upper, consolidated by acute catarrhal pneumonia in the gray stage. *Bronchi*.—Especially the smaller ones filled with thick yellow pus. All the other organs of the body normal, and the bones of the other parts of the body showed no changes.

I obtained possession of both temporal bones, and gave them to my friend Dr. E. C. Spitzka for examination. He was kind enough to furnish me with the following minute and careful description of the result.

Both temporal bones as well as the organs therein contained, presented exactly the same condition and appearances. The same description will therefore suffice for both.

The condition of preservation was bad. The bichromate of potash of the Müller's fluid, in which they were preserved, must have contained a considerable quantity of free acid, for the greater part of the bones had been decalcified. It was to be presumed that the more delicate structures within had likewise suffered by its excessive and prolonged action and such was found to be the case. The lining membrane of the cavum tympani was separated from the bone, the epithelium in the auditory canal and on the outer surface of the membrana tympani had macerated away, and under the circumstances any reliable examination was out of the question. *Membrana Tympani*.—Perfectly intact on both sides,

if anything, firmer and thicker than in perfect health. *Ossicula and Cavum Tympani*.—All the ligamentous and muscular connections were found intact. The bones were movable and it was particularly noticed that the insertion of the stapes into the fenestra ovalis was normal. So far as could be seen there were no traces of any catarrhal or other pathological processes in the left cavum. In the right there were a few thickened strands, and superficial erosions of bone on the *promontory*. These erosions might be attributed to the action of the preservative fluid opening the superficial channels of the tympanic plexus, to which the erosions corresponded in position and direction. *Cochlea*.—The left cochlea was opened the next day after receiving the specimens, and placed in alcohol, the other was left in the same fluid (Müller's), which had been previously employed. A portion of the lamina spiralis was detached, and contrary to all expectation presented recognizable appearances under the microscope. Specimens stained in hæmatoxyline and carmine showed normal epithelia, etc. The connections of the various elements with each other were very loose. *Semi-Circular Canals*.—An attempt was made to extract the membranous canals by Hyrtl and Lucae's method but failed, for they were unquestionably rotten. It was satisfactorily proven, however, that the *bony channels* were free, for bristles passed into them met with no resistance and emerged at the vestibule. *Auditory Nerves*.—These were the parts best preserved. The nerve fibres were normal, but a preternatural number of small granules were found scattered among them, as well as a few corpora amylacea.

Remarks.—In handing the specimens to Dr. Spitzka, I suggested to him the possibility of the occurrence of an osteoplastic process, similiar to that found in the other bones of the skull, in the internal ear. This was not found to be the case, for it may be definitely answered from the examination that no osseous growth whatever was present in any part of the auditory apparatus. It seems to me, although from the imperfect state of preservation of the specimen Dr. Spitzka's examination was necessarily rendered imperfect, we can nevertheless say with great certainty, that

no positive evidences of any disease of the middle or internal ear, which could account for such profound deafness, was present.

Neither the few corpora amylacea, nor the round and granular bodies, which were probably, (shrivelled blood corpuscles?) the result of a congestive hyperæmia can be considered as of much influence. Lucae has described the corpora amylacea in this situation and also in the cochlea in a case of syphilis.

In the absence of all evidence of disease in either the internal or middle ear, sufficient to produce such mischief, we must attribute the deafness to the thrombosis of the cerebral sinuses. Spitzka, however, does not see how such a profound cerebral change could be present without the patient being in a deep stupor, and unable to call attention to the deafness. But we have the post-mortem evidence of the existence of the thrombosis of the several sinuses enumerated, and the clinical fact afforded by the observation of the patient by myself and others, that she retained her consciousness until the last.

No positive diagnosis of the seat or nature of the lesion causing the deafness was ventured, except to state that there was some disease of the base of the brain. This was rendered evident enough not only from the deafness without any disease of the ear, but also by ischæmia of the optic discs and implication of the third and seventh nerves, as shown by the paresis of the upper lid and facial muscles. From the probable syphilitic character of the disease, it was suggested that there might be a gumma at the base. I am not aware, how it would have been possible in this case, to have diagnosed the existence of the thrombosis of the sinuses of the dura mater during life.

Wreden has published in these ARCHIVES, (Vol. iv, p. 52, et seq., and again in Vol. v, p. 74, et seq.) "Observations on Phlebitis of the Sinuses of the Dura Mater," as a Complication of Acute Otitis, in which he points out with great minuteness the symptoms by which the general diagnosis of phlebitis of these sinuses can be made. More than this, he advances the view that even the differential diagnosis of

the several sinuses affected can be ascertained. But all the signs by which such a diagnosis was arrived at in his two cases failed in ours, for in those which he so carefully analyzes, the thrombosis was of inflammatory origin caused by a phlebitis propagated by the veins leading to the sinus, we need not stop to enumerate these symptoms which are so carefully given in his papers.

The thrombosis in our case of syphilis, on the contrary, must have been of non-inflammatory origin, for both the etiology and symptomatology of the case are in favor of this view. Wreden carefully distinguishes between these two forms, and enumerates the different mechanical causes leading to obstruction in the sinus. (Vide, vol. iv. l. c.) Again the thrombosis in our case was not caused by otitis. But the idea will suggest itself that nevertheless it may have been the result of a phlebitis propagated by the extension of inflammation along the veins leading from the suppurative process in the bones of the skull. But there were no fever or pyæmic symptoms of any kind such as are seen in inflammatory thrombosis.

Moos has also reported in these ARCHIVES, (Vide, vol. vii, p. 465, et seq.), several interesting cases of Thrombosis of the Sinuses of the Brain. Case iv of the series, p. 474, is especially interesting to us in this connection, as there was the same as in ours, complete absence of any pronounced symptoms of phlebitis of the sinus. At the autopsy, however, thrombosis of the left lateral and left superior petrosal was found. Aside from the pain in the forehead and occiput in the beginning of the trouble, which toward the end passed into a continuous diffuse headache, and which could be referred to a meningitis, there was present only *œdema of the temporal* region. Moos considers the latter symptom of great value, but not pathognomic of phlebitis of the lateral sinus, because we cannot exclude the possibility that it is not the consequence or accompaniment of caries of the squamous portion of the temporal bone, or an abscess of the temporal lobe.

In our case there was marked swelling and œdema of this region, but it was most likely due to the changes going on

in the bones, which were most marked just here, rather than to any phlebitis.

In regard to the very extraordinary changes in the bones of the skull, I prefer to remain quiet. But although the decisive evidences of the presence of syphilis were wanting, it nevertheless seems to me that we must consider the process as a syphilitic one.

II.

Otitis Media Purulenta. Chronic Caries of Mastoid. Perforation. Purulent Meningitis.

Unfortunately, I have lost the notes of the history of this case, which I am therefore obliged to give from memory and cannot even furnish the date of the patient's visit to me.

The patient, a man of about 30, came to my office complaining of severe pain in the right ear and corresponding side of the head. He had had otorrhœa for a number of years but paid little attention to it. For a few days before seeking advice, the discharge from the ear almost ceased and the pain set in. On examination, there was but slight and very offensive otorrhœa, decided although not very great swelling of the mastoid region, which was exceedingly tender to pressure. There was a large perforation of the membrana tympani. I do not recollect the exact facts in regard to hearing, but he was very deaf. An incision was made over the mastoid, the bone found to be decidedly carious, and an attempt was made to break through it with a probe, but did not succeed. It was then advised that the mastoid should be trephined, but the patient would not consent to the performance of the operation. Several days later, I was summoned to his house in a great hurry. He had had a severe chill followed by a state of active delirium, and was quite incapable of giving any account of himself. Although it was evident that he already had meningitis, at the earnest solicitation of his wife, and as a *dernier resort*, I proceeded to perforate the mastoid. This was readily accomplished. After a few turns of a Buck's drill, a strong director easily entered the mastoid, giving exit to a large amount of stinking pus. I was kindly assisted in the operation by Dr. J. D. Anway, the patient being put under ether because of his excessive restlessness. The rest of the history is soon finished, there was no return to consciousness, delirium continued for some hours, after which profound coma en-

sued and death occurred in about forty-eight hours after the operation.

An *autopsy* was made about twenty-four hours after death, which I invited my friend Dr. Spitzka, on account of his well-known ability as a cerebral pathologist, to conduct.

Cadaveric rigidity well marked. Hypostasis. Upon removal of the calvarium purulent meningitis of the convexity and base as well as of the internal aspect of the whole right hemisphere was found. The inflammation had in no instance passed beyond the great falx, but it had passed the tentorium, as will be described. Red inflammatory softening existed over an area 7 *cm.* square at the apex of the temporal lobes, including one-third of the gyrus lingualis, with a part of the nucleus amygdalæ. There was also an abnormal depression of the cerebral surface in front of the gyrus præcentralis, and 7 *cm.* from the great longitudinal fissure which is still to be examined. Several layers of coagulable lymph and a thick creamy pus were found infiltrating the meshes of the pia and arachnoid, lying free on the surface under the dura.

There was no morbid appearance whatever of the left hemisphere, other than an arterial injection of its membranes, its tissue was firm and healthy in every part. A greenish discoloration of the tentorium on the right side of the median line near its anterior border was observed, which was covered by an adherent pseudo-membrane of a yellow color. From here an extension of the inflammation took place to the upper surface of the cerebellum. In the inflamed area, the cerebellum had a greenish red-yellow mottled appearance. This appearance was symmetrical, if anything the right was larger than the left, extending from near the middle of the anterior vermis to both cerebellar hemispheres. Tentorium on the left of the median line was normal. The chiasma, pons, crura, and pyramids normal. The decussatio pyramidalis was hardened and carefully examined but no abnormality was found. An incised wound 2 *cm.* behind the right concha, about 5½ *cm.* long, extended vertically, leading to a purulent cavity with roughened bony

walls. This did not directly reach the antrum, but a cavity composed of the fused mastoid cells.

The dura mater which was not adherent to the cranium at the convexity, was abnormally so over the tegmen tympani, it was abnormally loose and ragged over the impressio trigemini, near the internal opening of the carotid canal. At both these points it was of a greenish color and injected with tortuous vessels in the vicinity of the discolored area. The impressio trigemini was eroded and of a blackish-green color, and on removal of the temporal bone gave forth a fetid odor. But a subsequent examination showed that the bone between this portion and the tympanic cavity was healthy, and therefore this change is to be considered as consecutive to those in the basal dura. The facial hiatus as well as the hiatus aquæductus vestibuli were filled with their natural contents and showed nothing abnormal. The tympanic cavity, mastoid antrum and cells, vestibule, semi-circular canals, Eustachian tube, and canal for the tensor tympani were all filled with a thick cheesy pus, (thick in the alcohol specimens). The anterior inferior third of the membrana tympani was intact and attached to the manubrium. This part of the membrane was very much thickened. The rest of the membrana tympani was wanting and the bone was denuded of all soft covering at the rim of attachment for the upper and posterior two-thirds. The malleus was present, entirely and firmly fixed by its normal and some morbid attachments. The other bones had disappeared, not even the slightest fragments of them could be found although the dissection was done under water. Both fenestræ, as well as the internal surface of the vestibule and tympanic cavity were eroded upon their margins. That portion of bone which covers the mastoid cells and antrum was greenish, thin and soft, (evidently necrotic). The tegmen tympani is exceedingly thin, but not more so than is sometimes seen in health. The thin portion has a decided greenish tinge and is surrounded by a halo of injected bone blood-vessels.

Remarks.—The post mortem examination showed no perforation in any place, and the conclusion to be arrived at from it is, that there was a purulent meningitis limited to

the right hemisphere secondarily affecting the upper surface of the cerebellum, and caused by a propagation of the purulent otitis by contiguity, not by perforation.

The appearance of the tegmen tympani suggests the probability that the propagation was in this direction, although perhaps coincidently with the necrotic roof of the antrum. It is also very probable that if the operation of trephining the mastoid had been performed when first proposed before meningitis had been declared, the patient's life might have been spared.

III.

Otitis Media Purulenta (Traumatic?). Extensive Caries of the Temporal Bone. Perforation of the Mastoid. Death. Autopsy.

Patrick Boylan, æt. 45, a shoemaker, was admitted to the Charity Hospital May 26, 1876. The patient gave no history of any hereditary disease, but said that four years ago he contracted syphilis, of which he does not now, however, present any symptoms.

Three weeks previously he was beaten most severely over the left side of the head, and states that one week afterward he became quite deaf and a thick yellowish discharge took place from the left ear. Since the discharge appeared it has been very painful, so much so that he has been unable to sleep.

Condition on admission.—General health is good. He complains of whistling and buzzing noises in the affected ear. (The other was quite normal.) $H=0$; $V=\frac{1}{2}$. There is copious otorrhœa, and a large perforation of the membrana tympani (the site of the perforation is not noted). The whole mastoid region is diffusely swollen, very red, and painful on pressure. The whole side of the head was exceedingly painful. It was decided to perforate the mastoid, but on account of the strenuous objection of the patient to any operation, it was not done at this visit. At my next visit to the hospital, however, May 30th, he gave his consent. After the patient was etherized, an incision about 5 cm. in length was made parallel with and about 2 cm. posterior to the insertion of the auricle. The incision was carried to a depth of more than 2 cm. before the mastoid process was reached, as the tissues over it were so infiltrated with inflammatory products. An opening was then made by a small drill through the bone, in the usual site, into the mastoid antrum

and a large amount of pus let out. The bone was decidedly carious. May 31st.—This morning the patient feels much better. He has slept well, about five hours last night, and complains of but little pain. His temperature is 98° , and pulse 66 per minute, full and strong. The ear was carefully syringed with warm water, some of which passed through the opening in the mastoid process. There was continued improvement from this time until June 18th, when he began to complain of severe pain in the head, especially at night. The ear was kept carefully cleansed, and the opening in the mastoid free; but, there was no amelioration of his symptoms, the pain became worse. I went off duty at the hospital the end of June, but was kept informed of the progress of the case by my house surgeon. Early in the month of August he became dull and stupid, slept most of the time, when awaked appeared lost and it took some time for him to answer questions. On August 16th, he went into a comatose condition, his breathing was stertorous and slow, pulse weak, feeble, and increased in frequency. The day following he died at 9 A.M.

A *post-mortem examination* was made twenty-four hours after death by the Curator of the Hospital, which is taken from the Hospital records. An open wound 4 *cm.* long, parallel with and $\frac{1}{4}$ *cm.* behind left ear, communicating with a cavity in the mastoid process. *Head.*—Calvarium normal, on exposing the surface of the brain, the vessels of the pia mater were seen to be destitute of blood; convolutions markedly flattened. On removing the brain which was very flabby, an abscess was opened into, in the left middle lobe, which gave exit to a considerable quantity of thick yellowish pus. Throughout the whole left hemisphere at the base, there was marked pachymeningitis, and a small oblong yellowish-white growth attached to the dura mater over the outer border of the petrous portion of the temporal bone. Over this region the membrane was loosened from the bone, and smaller scattered growths were present. Section of the brain showed pus breaking into the lateral ventricle, destroying the septum lucidum and entering the lateral ventricle of the right side, the brain bounding it being superficially softened. The primary abscess was located underneath the outer and posterior border of the left optic

thalamus; the whole middle lobe, posterior portion of the anterior, and anterior portion of posterior lobe, (*same side*), was almost diffuent and everywhere the brain substance was pale and flabby.

The petrous portion of the temporal bone was removed and found to be extensively carious, the outer half of its inner surface was roughened and showed several small perforations.

The outer surface showed the perforation made by operation two months ago. The other organs of the body were not examined. Nor was there, I regret to say, a careful dissection of the temporal bone made.

Remarks.—In this case we have an illustration of another of the modes by which a fatal result ensues from a chronic purulent otitis. Caries and perforation causing an abscess of the brain. It is worthy of remark that so long a time, more than two months, ensued after perforation of the mastoid was performed before the fatal issue. It is probable from the character of the abscess that it formed after the operation. It was evidently not an old one, for the walls were so thin that it readily ruptured and allowed its purulent contents to escape, pus was also found in the adjacent cavities of the brain. While the operation may be supposed to have averted the immediate danger of death, therefore it did not stop the progress of the necrosis which caused perforation in several places, and in this way permitted the propagation of the disease to the brain. It is to be regretted that the growth attached to the dura over the temporal bone was not more carefully examined, but it was most likely thickening of this membrane itself from pachymeningitis. It may however, have been a gummy growth.

A CASE OF ROUND-CELLED SARCOMA, ORIGINATING IN THE TYMPANIC CAVITY.

By ARTHUR HARTMANN, OF BERLIN.

Translated by H. KNAPP.

THE rarity of malignant tumors starting from the ear and ending fatally may justify the publication of the following case.

O. J., æt. $3\frac{1}{2}$, was first seen October, 1878. His parents and brothers and sisters were perfectly healthy. He himself was the picture of health and had never been ill. Four weeks previously, serous discharge from the right ear had set in, without pain or inflammatory symptoms. Two weeks later, the mother first noticed the appearance of a tumor in the ear-canal, which since has steadily grown. On examination, I found the orifice of the external meatus occupied by a polypus, the size of a pea, which I removed with the snare. In the depth of the canal, other polypi were noticed, and in part removed at once, in part during the next sessions. In spite of cauterization of the roots with chromic acid, the swellings returned in a few days. They looked like ordinary granulations with a grayish-red color and smooth surface. In order to remove all the swellings radically, I narcotized the boy and applied the snare with great ease, since the ear canal was wide. Nothing of the membrana tympani and ossicles could be discovered, and it was surprising that the tumors did not start from one place only, but from all sides of the inner end of the meatus and drum cavity. Irregular prominences, left after removal of the principal masses on the inner tympanic wall, were touched with chromic acid. In a few days, proliferation of the remnants occurred, and in spite of repeated cauterizations the whole meatus

was soon filled again. At the end of October, I removed under chloroform the larger tumors with the snare, and destroyed the deeper parts with the pointed galvano-cauter. After this the tumors from the depth of the ear canal again developed, and the surroundings of the ear, the parotid as well as the mastoid and infra-auricular regions began to swell, an abscess formed below the ear, was incised and its cavity which communicated with the auditory meatus kept open by a drainage tube. The painfulness rapidly subsided, but a number of other tumors formed in the vicinity of the ear and in the meatus.

Parts of the masses removed were examined under the microscope by Dr. Jürgens, assistant to the Berlin Pathological Institute, and proved to be round-celled sarcoma. The nodules had a medullary appearance, bright-red color, and soft consistence. Numerous round cells and some spindle-shaped elements were embedded in the scant intercellular substance.

The steadily increasing tumor carried the auricle more and more outward. At the end of February, the tumor had attained the size of a goose-egg, and the general health of the patient began to decline. Bronchial catarrh, loss of appetite, diarrhoea, emaciation and headache set in. On March 21st, bilateral convulsions in the extremities made their appearance, lasted several hours and disappeared completely. Mastication and deglutition were interfered with by a prominence in the right side of the fauces. Two days before his death, which occurred March 28th, the convulsions reappeared and were accompanied by loss of consciousness and coma.

Autopsy.—The tumor was 14 cm. in length, 12 cm. in breadth, and 9 cm. in height over the external surface of the skull. On its crest was the auricle, behind and in front of which there were numerous ulcers which discharged pus on pressure. The tumor consisted of different lobes varying in size from that of a walnut to a hen's egg. Its anterior part inclosed a pus cavity. The upper and posterior walls of the meatus, the roof of the tympanic cavity, and a part of the squamous portion were destroyed by the pseudoplasm. Through this defect in the capsule, the external tumor was in communication with another situated in the cranial cavity. The intracranial tumor projected 1.5 cm. over the inner surface of the skull, covering the whole squamous portion and the external half of the upper surface, as well as a small part of the posterior

surface of the petrous portion of the temporal bone. The inner auditory canal was completely free. The outer part of the mastoid process was destroyed and the mastoid cells were occupied by the substance of the tumor. The inner portion of the mastoid process was likewise invaded by the tumor, and it was easy to separate the connection between the petrous pyramid and the mastoid process. The labyrinth proved perfectly healthy. Of the ossicles, only the stapes was found embedded in the mass of the tumor.

Remarks.—Whereas in the majority of cases the development of intratympanic tumors was preceded by chronic otorrhœa, and the formation of polypi, indicating their inflammatory origin, the pseudoplasm under consideration had from the beginning a malignant aspect, characterized by the absence of irritative symptoms, by its development from all parts of the cavity, and its exceedingly rapid growth. It is not likely that the pseudoplasm originated in the cranial cavity, extending from the dura mater to the tympanic cavity, since cerebral symptoms appeared only in the last stage of the disease,

As sarcomatous tumors spring from the connective tissue, the pseudoplasm under consideration probably originated in the submucosa of the tympanic cavity.

According to its histological condition, the tumor belonged to the class of soft sarcomas which, consisting of round and spindle-shaped cells, frequently attain, especially in children and young people, an immense size, and terminate fatally in a very short time. On account of their similarity with brain substance, they have been termed medullary or encephaloid tumors, and if very vascular, fungi hæmatodes. In harmony with the different modes of growth of sarcomas, I found also in this case capsulated tumors, first appearing as large subcutaneous nodes, and diffuse infiltration of the bone, causing softening and destruction.

Since soft sarcomata are distinguished by rapidity of growth, it is impossible to decide whether or not, in the foregoing case, the cause of the disease was accelerated by the operative procedure. As to the indications of operative interference, I should say that, in cases which, if left alone, invariably terminate in death, an attempt at removal of the

pseudoplasm, even with slight chances of success, would always be justifiable. I have found only one similar case reported in literature; it is published by Wishart in the *Edinburgh Med. and Surg. Journal*, and cited by Toynbee, in his treatise on "The Diseases of the Ear," p. 392, ed. 1868, by James Hinton. "The subject was a child 3 years old, in whom, after suffering for some weeks from severe pain in the right ear, followed by discharge, a tumor appeared surrounding the ear, and which speedily ulcerated, discharging a large quantity of fetid bloody matter; hemorrhage also frequently occurred. The child died within fifteen weeks after the appearance of the disease. On a post-mortem examination, the tumor was found to be as large as the child's head; externally it had caused the destruction of the condyloid process of the lower jaw; the zygomatic process was also gone. The tumor had advanced inward, destroying the whole of the petrous bone, and extended upward through a large orifice in the squamous bone, so as to form a depression on the middle lobe of the brain, which was in other respects quite sound."

BRIEF REMARKS ON THE AFFECTIONS OF THE AUDITORY ORGAN OCCURRING IN TYPHUS FEVER.

BY ARTHUR HARTMANN, OF BERLIN.

Translated by H. KNAPP.

DURING the epidemic of typhus fever in Berlin, in the spring of 1869, I had an opportunity of examining the auditory organs in a number of patients of the Moabit Hospital. The examinations were made during the stage of convalescence, since they were impracticable at the height of the fever, on account of the stupor of the patients. In 15 per cent. of the cases death occurred during the febrile stage; these were excluded from the examination. This will not materially alter the final results, since it was found that the auditory organ, in the severe cases, was not otherwise affected than in the mild ones.

Among 130 patients examined, 42 showed affections of the auditory organ, which may be classified as follows:

Impacted cerumen in the ear canal	6 cases.
Intumescence of the tube, with catarrh of the drum cavity	14 "
Acute otitis media, without perforation of the drum-head	4 "
Acute otitis, with perforation (double-sided in three cases, one-sided in six, accompanied with mastoid periostitis in two, with periostitis and granulations in the ear canal in one)	9 "
Increase of noises and hardness of hearing previously present	3 "
Recurrence of previous otorrhœa	1 case.
Noises, without abnormal condition	2 cases.
Affection of labyrinth	3 "
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	42 cases.

The plugs of cerumen manifested themselves by noises and hardness of hearing, and in two cases by pain, which symptoms disappeared after removal of the plugs with the syringe.

The presence of affections of the tube, the drum cavity and the labyrinth show that the disease affects the whole auditory organ, yet in such a way that in some cases one part of it, in others another part suffers most.

The cases entered as intumescence of the tube and catarrh of the drum cavity showed noises, hardness of hearing, retraction, slight injection and discoloration of the drum-head. They improved at once by inflation, and were soon cured. In three cases the symptoms appeared during the fever; in two during the defervescence; in the remaining nine in from three to seven days after the subsidence of the fever.

Acute inflammation of the drum, with varying intensity of pain, noises, hardness of hearing, marked injection, opacity and imbibition of the drum-head, was followed in nine cases by perforation and otorrhœa; in four by recovery without it. In two cases with bulging of the drum-head, paracentesis was not resorted to, though, according to the present views of the profession, it seemed indicated. Both cases took a favorable course. In the nine cases with perforation of the drum-head, the first inflammatory symptoms set in in one during the febrile stage, in seven during the first week, in one three weeks after the subsidence of the fever. Otorrhœa, without previous pain or other inflammatory symptoms, occurred as the first symptom in two cases; in the others from two to five days after the outbreak of the first symptoms. The openings were very small in all cases; they were situated in the lower half of the membrane in eight cases; in the posterior upper part, in one; in the anterior upper, in three. In the six cases of one-sided perforation, the other side was also more or less inflamed. In three cases the hardness of hearing and the diminution of the bone-conduction were so pronounced that a participation of the nervous apparatus in the disease had to be assumed. In one of those cases the objective exam-

inations showed no abnormality in the drum cavity; in the two others only slight alterations. Since there was no corresponding depression in the functions of other organs, the deafness in the last named cases could not be ascribed, as some authors on typhoid fever do, to general weakness, but to inflammatory changes in the labyrinth.

In almost all cases of typhus exanthematicus, the general hyperæmia of the head is accompanied by marked hyperæmia and swelling of the naso-pharyngeal mucous membrane. It seems that a congestion of the auditory organ forms an essential part of the general congestion of the head. If it persists after the convalescence from the general disease, exudation may occur in different forms either most pronounced in the drum cavity or the tubes or the labyrinth. That those different forms depend on the same morbid process, is proved by the occurrence of one in one ear, and the other in the other ear of the same patient.

The course and termination of the aural affections were very favorable, since complete recovery was noted in the majority of cases at the time of their discharge from the hospital. The two cases of mastoid periostitis recovered fully after incisions through the skin, liberating a great quantity of matter. The cases classified as affections of the labyrinth also recovered soon and completely.

Observations on the deafness in typhus fever are as yet scarce. Griesinger mentions only that it seemed not to be a nervous symptom, but due to catarrh of the middle and external ear.* Lebert† states that hardness of hearing occurs mostly at the end of the first or beginning of the second week, which is at variance with my observations, since the hardness of hearing, in the majority of cases, set in only in the stage of convalescence.

* *Virchow's Handbuch der Pathologie und Therap.*, Infektionskrankheiten.

† *V. Ziemssen's Handbuch d. spec. Path. u. Therap.*, Infektionskrankheiten.

ON THE SUBJECTIVE NOISES IN THE EAR.

BY DR. GUSTAV BRUNNER, OF ZURICH.

Translated by JAMES A. SPALDING, M.D., Portland, Maine.

I NEED not offer any especial apology for communicating in this paper some observations on subjective noises in the ear and remarking upon their nature, since, as a whole, but little has been published bearing upon this province, which is as interesting as it is obscure.

I.

I will begin with a few remarks on the conjectural *nature of ringing in the ear*. Two years ago (*Monats. f. Ohrenhlkde*, No. 4, 1873), I attempted a more accurate analysis of the symptoms* produced in the ear by the report of fire-arms, but did not succeed in discovering a satisfactory explanation for the ringing in the ears that regularly ensued. Let us first consider a few examples which appear especially pregnant to me.

Mr. N., professor of chemistry at Pesth, with perfectly normal hearing, told me that after exploding fulminating gas during his lectures, he always perceived in his ear a high, clear tone, resembling a high violin tone, which continued to annoy him for a considerable time. He noticed this same phenomenon while in the compressed air-chamber used in bridge-building. When the valve

* Amongst others, "sudden hardness of hearing (deafening) on the affected side, accompanied with a disagreeable *feeling of fulness*, and *high ringing in the ear*. External tones and noises, moreover, had a high, metallic, accessory resonance, especially in the case of one's own voice, and noticeably when whistling in the higher octaves."

was closed, he felt a pain in his ears, and at the same time heard a high tone which lasted for a long time.

Every artillerist knows that when cannon are discharged he perceives a high ringing sound in his ears, accompanied with a certain hardness of hearing, which lasts for a longer or shorter time. The same phenomenon is perceived in a less degree when a gun is fired off, and again, though not constantly, during Politzer's experiment. We may therefore propose the following general theorem: *When a sudden, violent wave of air strikes our ear, a ringing in the ear ensues, which lasts for a longer or shorter time (and is usually accompanied with a certain degree of deafening).*

This observation is most instructive in a space filled with compressed air, where there are but occasional waves of air which shake the delicate organ of hearing with unusual violence. The thought then struck me whether, *in such a case, the ringing in the ear* could not be regarded (like the perception of light when the eye is subjected to pressure) as a mechanical irritation of the auditory nerve rather than an irritation transmitted by the specific terminal organs in the labyrinth. There is much to favor the supposition that a single sudden vibration of air is much more likely to irritate the fibres of the auditory nerve by pressure or pulling than to set the various terminal organs of the labyrinth into their usual activity, just as pressure on the eye can stimulate the function of the optic nerve fibres, but not of the rods and cones of the retina.

Still it is remarkable in such cases, that a tone more or less high is always heard, although not always the same tone.* Unfortunately, physiology does not tell us with what tone-perception the auditory nerves respond to the mechanical irritation, and this will be difficult to establish when we consider its hidden situation.

On the other hand, we know that *ringing in the ear* has

* A remark of Oscar Wolf's ("Experiments with Edison's Phonograph." These ARCHIVES, vol. viii, page 63) here deserves mention: "Since our auditory nervous apparatus is extraordinarily sensitive to the highest tones of the scale, so that they can occasion considerable pain to the healthy ear, it is highly probable that the corresponding most sensitive terminal filaments of the nerve are affected in diseased ears, most probably by sympathy."

been observed as the normal reaction when applying the constant current to the organ of hearing. Thus Erb* says: "With cathode closure, I hear a high, metallic sound, as in spontaneous ringing in the ears." Brenner† found in those cases where the persons under observation were able accurately to determine the pitch of the sound, that it was always in the middle octave, now c^1 , again g^1 .

In a case under my own observation, I also found c^1 . Hagen,‡ on the contrary, found a^4 in the case of a pianotuner. So far as I know, no one has ever observed any tones lower than those of the middle octave. Instead of the sensation of sound, we occasionally meet with noises, some of which, *e.g.*, the buzzing of a bumble bee, correspond to a deeper octave, but setting aside the facility with which noises can be produced by the application of the electrodes, and the possibility of regarding these as muscular noises, the more or less high singing-sound just mentioned is, according to all observers, the normal sound, *i.e.*, the reaction perceived in healthy ears. Experiments have proved that the labyrinth and the auditory nerve fibres are penetrated by the current during galvanization. If now, as is the case with most electro-therapeutists, we might be sure in assuming that the ringing perceived in the ears during the experiment is the reaction of the auditory nerve to the constant current, we might go further, and be justified in assuming that the auditory nerve also responds to (coarse) mechanical irritation with ringing in the ears, as seems probable from the above-mentioned observations, in compressed air-chambers.

I treated a girl of 17 for chronic otorrhœa (right ear) with defect in the *M. T.* Hearing, $\frac{6-8}{800}$ cm.; a granulation with a broad base rested near the promontory. Whenever I touched this spot with a fine probe, or pressed upon it with a platinum wire coated with argent. nitr., the patient always complained of a *violent, clear ringing* in her ear, which we are tempted to explain by a shock of the cochlea lying in-

* *Archives of Ophthal. and Otol.*, vol. ii, part 2, page 263.

† *Electro-Otiatrik*, page 110.

‡ *Pract. Beiträge zur Ohrenheilkde*, Band vi, pag. 18.

side the promontory, just as we have perception of light, when the globe of the eye is pressed. I am confident that the stapes was not touched during this observation.

In the same way, spontaneous ringing in the ear might be simply explained as the mechanical irritation of a fibre of the acoustic nerve (*e.g.*, by the current of blood) just as we see sparks. So far as I have observed on myself, the sound is always perfectly pure and clear, but not always of the same pitch. Still it always lies between the middle and upper octaves of the piano. It is interesting to notice how distinctly it dies away, as when a glass has been struck, and further, it is well known that the phenomenon is more frequent in diseased ears (*otitis media catarrh. chron.*)—than in those that are healthy (*hyperæsthesia of the acoustic nerve or disturbances in the circulation?*).

I would also include in this category, the ringing in the ears which in many patients is transferred to the auditory nerve from other nerve tracts, and which, for the sake of brevity, I will call *reflex ringing in the ears*. Thus it has often been observed that patients heard a tone in the ears on closing the eyelids. In such cases there must have been some obscure affection of the labyrinth, or more broadly expressed, of the terminal apparatus, and I suspect that *hyperæsthesia of the acoustic nerve* must at least have been present. Here is one of many such examples.

A girl of 15, with considerable deafness, heard ringing in her right ear whenever she closed her right eye firmly. Rotation of the eyes and pressure of the globe did not produce the same result.

A loud-ticking cylinder watch was not heard through the bones of the head (which, considering the patient's youth, indicated some labyrinthine affection, and the examination of the tubes and *M. T. T.* was negative, except that the latter were of a violet hue. On the other hand, the patient complained of annoying subjective noises (humming) in the head. Examination with the constant current showed altered formula (especially) *left*, where whistling and noises ensued in all the changes from cathode-closure to anode-opening, while from the *right* side the so-called paradoxical reaction appeared in the *left* ear, with cathode-opening and anode-closure.

I am now treating a gentleman for otitis med. cat. chron. complicated with disease of the labyrinth, every slight shaking of the head causing a "fine, clear ringing" in both ears.

He suffered frequently in youth from nasal catarrh, and was exposed to many colds. He has noticed a slight deafness for twenty-five years, and in later years transitory subjective noises, which have become quite violent within a month. He has just returned from a year's stay in South America, and the mucous membrane of the naso-pharyngeal space has been continually affected ever since. He hears chiefly an incessant hissing in both ears, and a roaring in either ear alternately. Both *M.T.T.* show diffuse opacity.

An interesting case by Zaufal* also belongs to this class.

A blind piano-tuner, whose left ear had been affected for three weeks, heard in this ear a clear tone, corresponding exactly to *c'* when the left tragus was pressed upon, or even when it was merely smoothed over. He heard the same tone on the same side, and even more distinctly when the right tragus was touched. Zaufal regards this as a case of reflex ringing, communicated to the auditory nerve from the sensitive fibres of the skin.

I will next mention a case of my own, in which a deep humming noise was heard when the eyes were closed.

A young man of 19 consulted me in 1872 for deafness of the right ear, which had appeared without any known cause or especial symptoms. As I could give him but little hope, on account of the negative result of the examination of the middle ear, defective bone-conduction, etc., he could not be made to understand the need of any treatment, as the hearing of his left ear was still normal. A year later, the left ear also became affected during the winter, with an indescribable violent humming noise, accompanied with considerable deafness.

When he came under treatment two months later: Hearing watch $\frac{2}{500}$ cm. (He had been totally deaf during the first four days of the attack.) The left *M.T.* was very glistening, and of a

* *Wiener. Med. Wochenschr.*, 1872, No. 4.

bluish-violet tint; the right *M.T.* was grayish. The large *C*¹ tuning-fork was not heard anywhere on the cranium, even when set into forcible vibration, and only slightly through the upper incisor teeth, less than by the air; the same with *C*², and smaller forks were not heard at all.

The history of the case, as well as the state of the parts concerned, led me to diagnosticate an affection of the labyrinth, although tubal catarrh and chronic nasal catarrh were undoubtedly present to a considerable degree. For this reason I avoided all interference in the tympanum.

After six weeks' treatment (repeated free blood-letting over the mastoid process, exhibition of potass. iodid., nasal douche, gargling), bone-conduction was again restored, the subjective noise had disappeared even on closing the eyes, hearing was improved somewhat, and the patient could no longer be kept under treatment. He continued well for three years, when a relapse followed from a cold which he caught while going about in melting snow. He reported for treatment three weeks later, with the same symptoms as before—rapid decrease in hearing, loud humming or whizzing in the left ear, like the buzzing of a large fly or the humming of a fly-wheel when revolving rapidly, or the tone of a staff-shaped *c*² fork when held before the ear, only much louder. Every time that he closes the eyelids or contracts the orbicularis the same sound is perceived; in a short time it dies away. It seems as if, when the lids are closed, a great fly-wheel were set into rapid motion, then revolved slower and slower until it came to rest in three or four minutes. When he stoops, the humming begins just as when he closes his eyes, and on many days when he opens his jaws widely, but it is not then so violent as during contractions of the orbicularis. The subjective noise is louder when he is lying down than when sitting or standing.

The bone-conduction was diminished as before; the *C*¹ fork only heard weakly from the teeth, but loud in front of the ear. The examination (the *left* ear is always meant) with the piano is interesting. All the tones above the middle octave are heard clearly (even a *C*⁶ fork is heard in spite of its weak tone), while those below show different limits on different days, when, instead of a tone, the patient hears a dull noise (as when he shuts his eyes or as when we close our ears firmly with both hands) and feels a disagreeable shock in the ear. When he came for treatment, all tones from *C*¹ downward sounded dull, *i.e.*, without tone; he

could, however, still distinguish that d^1 (great octave) was lower, and C^0 higher than his subjective noise, which he located between f^1 and g^1 . Two days later, Dec. 15, 1876, the dull hearing with shock in the ear was perceived at C^0 , an octave lower; above this, all notes were clear. But it is remarkable that f^1 sharp and g^1 are now clear, while f^1 and g^1 sharp cause a shock, which is, however, not so annoying as before, and the subjective noise is less violent. Dec. 17th, the shock is most disagreeable at C^0 ; lower tones cause less disturbance; the great octave from C^1 to b^1 sounds clearly, and he locates the subjective noise at g^2 , i.e., an octave lower than before. I noticed also, while drawing the *M.T.* outward by suction, that the subjective noise ceased, and was not perceived even on closing the eyelids, so long as the rarefaction continued undiminished. But when the tube ceased to produce perfect action, as well as after Valsalva, the humming began as soon as the *M.T.* was again drawn inward (tubal stenosis). Dec. 19th, the keys C^1 to f^1 , and Dec. 20th, only C^1 caused a shock in the ear; the subjective noise was again fixed at C^0 , but was followed by a relapse, when the shock and dull feeling began at A^0 , embraced all the lower keys, and the subjective noise was again more violent, with simultaneous decrease of hearing and a feeling of fulness in the ears. Dec. 29th; some improvement; only d^0 , d sharp 0 , and e^0 caused a shock in the ear, and the subjective noise corresponded to e^1 (not in the patient's compass). Jan. 1, 1877, the subjective noise was at a^1 ; b^1 and C^0 were dull, and caused the shocks in the ear. An improvement followed gradually, the subjective noise appeared only when the eyes were closed, and the patient thought that the noise would disappear if he should never move his eyelids. When I rarefied the air in the catheter by suction with the air-bag, during which I heard a distinct sharp snap with the auscultation tube, the subjective noise disappeared, and was not again perceived so long as the aspiration lasted, even on closing the eyes. This symptom as we saw above, happened also during rarefaction of the auditory meatus. January 9, 1879, the patient left at his own desire, although the affection was still present, e.g., the large C^1 tuning-fork was only heard by bone conduction when struck very forcibly; watch $\frac{10}{100}$ cm. So far as I have learned, the condition has improved somewhat at home. The treatment had been the same as three years before—repeated blood-letting at the mast. proc. (seven times in six weeks, 70–100

gram of blood), exhibition of potass hydroid, bitter water, nasal-douche and gargling. I used the catheter a few times and rarefied the air in the meatus for a long period without especial result.

The whole picture of the disease, the sudden origin, the extreme deafness, the negative state of the *M.T.*, the youth of the patient, the very defective bone conduction, and especially the tests with the piano, etc., all indicate that the labyrinth chiefly was affected in this interesting case, although complicated with well-defined symptoms of otitis med. cat. chronica. But I do not venture to give a decided opinion of the nature of this labyrinthine affection, nor of the buzzing, humming noise. If we regard this noise as analogous to ringing in the ears, which it resembles in its regular dying away, we have yet to explain why it was a humming instead of a ringing noise. We might suppose that certain districts of the labyrinth in the region of the lower tones were chiefly affected and hyperæsthetic, since all the tones from the middle octave upward were always heard clearly during the whole term of the disease.

These could not have been muscular noises, for muscular noises lie deeper in the scale—Preyer located those of his own tensor tympani at 18-21 (double) vibrations, and Helmholtz those of a frog's muscle at 18-20—and have a *much more constant pitch*, while the noise in this case vibrated between C° and f^2 . Nor does the characteristic dying away of the humming noise, that originates when the eyes are closed, seem appropriate for a muscular noise, and it must be taken into consideration in the explanation.

I will here cite another observation of Wolfe's,* which is interesting on account of the epicrisis.

This was a case of *one-sided deafness following a detonation*; a shot was fired in a room directly behind the patient's ear, and caused deafness with ringing in the ears (lying moderately high in the scale and called "singing"), both symptoms lasting for eighteen months, during which the patient was under observation. Watch on contact only; testing with the voice showed defective perception of the *F* sound, which lies between a^2 and a^3 in the scale.

* *Archives of Ophthalm. and Otol.*, vol. iv, part 2, page 269,

Ha was heard instead of *Fa*. Wolfe, therefore, diagnosticated a hemorrhage into the cochlea, limited to the twice-marked octave (corresponding to the *F* sound), and says in the epicrisis: "This is a case of irritative or defective perception on the part of single fibres of the auditory nerve, manifesting itself on the one hand by the continuous subjective perception of certain tones of the scale (singing or seething), and on the other by the incapacity for perceiving the *F* sound, which possesses a similar quality of sound."

Such a view would explain the continuous singing, but not the simultaneous deafness. Wolfe overlooks the fact that ringing or singing is a quite constant symptom after detonations, usually transitory, but sometimes permanent, in which latter case it assumes more the character of the singing so frequently observed in otitis med. cat. chron. If Wolfe's diagnosis were correct, a corresponding defect of perception should have been confirmed on the piano, analogous to the defective perception of the *F* sound, but of which no mention is made, and which I have never yet observed in similar cases. Or was, perhaps, the perception of the *F* sound interfered with by the similar character of the subjective noise?

I have just considered the origin of the case after detonation, as the general reaction of the auditory nerve when directly irritated (*i.e.*, without the intervention of the accessory organs of the labyrinth); but still I do not deny that many things favor the view that the organs destined for the perception of high tones are so sensitive that they are preferably affected by every irritation, whether coarsely mechanical or electric, that touches the ear. But if this in and by itself explains the ringing in the ears in question, it is still remarkable that the high octaves are not only affected more violently than the lower, but even exclusively affected. Again, according to this hypothesis, we ought to expect a disturbance of perception (at the piano *e.g.*) corresponding to the subjective ringing, *i.e.*, in the more simple cases a more or less noticeable hyperæsthesia for the tones concerned, and in the more difficult cases a paralysis, even if transitory, a defect of perception, or even disturbance of

perception which up to this time I have never observed, with the exception of the previously mentioned metallic accessory resonance when whistling the higher tones. This point seems to me to deserve especial attention in the future.

II.

Noises moving to and fro in the higher octaves, such as fine high singing, chirping of crickets, seething, etc., more related to ringing in the ear than roaring, appear in many diseases of the ear, especially in the later stages of simple otitis med. cat. chron. In my experience they represent the usual and most frequently observed form of subjective perception of sound in these cases, while in acute inflammation of the middle ear, the patients complain more frequently of roaring.

In so far as I have been able to observe in others and on myself, the *ringing* or singing in the ear in otitis med. cat. chron., is not always of the same pitch, but moves about generally in the higher octaves (fourth and fifth marked octaves), and does not fall below the once-marked octave. It is most frequently compared with the high singing or chirping of crickets and grasshoppers, while many patients compare it with the singing or seething of a tea-kettle. It is continuous, rarely throbbing; in most cases it is not very annoying, and frequently is imperceptible except amidst quiet surroundings. It is increased by mental exertion and excitement, and is usually less noticeable in the milder seasons of the year than in raw and wet weather. Properly speaking, the noise is made up of several high tones lying pretty near together, and alternating with one another. For myself, I regard the comparison with the chirping of grasshoppers as very apt. Now and then a clear high tone (in my own ears, usually at the beginning of the fifth-marked octave or end of the fourth, occasionally a trifle higher) rises above the seething or chirping, lasts for some time at the same pitch, like the well known transitory ringing in the ear, and then is lost again in the chirping noise.

Lucae* mentions an observation on himself which seems to belong here. He says: "When working laboriously, especially at night, I frequently noticed a high delicate ringing in my left ear. It seems to appear preferably when I have a pharyngeal catarrh, but does not always accompany it. I had no difficulty in fixing the tone that predominated above the subjective sensation of sound, as f^3 , and it was always of the same pitch. I would say that the f^3 is only one of the tones chiefly heard, and that we might express the whole phenomenon thus:



The subjective noise is not strengthened when I touch the corresponding objective notes on the piano. When I make the left *M.T.* tense by Valsalva, the phenomenon disappears at once. A single impression of air usually suffices to free me for several days from the subjective sensation of sound, provided that the ear is not too much exerted by examinations during that time. I can voluntarily produce the same phenomenon, composed of the same tones, by firm closure of the meatus,—that is to say, during increased labyrinthine pressure,—when it appears as an accompaniment to the much deeper rythmical humming noise observed under such circumstances."†

My own chirping noise also is not reinforced by striking the corresponding tones on the piano. I cannot, however, express it in music as exactly as Lucae has done, but it seems higher. Lucae is inclined to refer his subjective sensation of sound in general to increased pressure in the labyrinth; he explains its disappearance after Valsalva by an associated outward movement of the stapes, and consequent diminution of pressure in the labyrinth; as for the rest he will raise no further hypothesis. According to Politzer's experiments there can be no doubt but that the pressure

* *Archiv für Ohrenheile*, band iv, page 39.

† I shall speak of this latter noise further on. I hold it to be entotic, *i. e.* an autoperception of blood- and muscular-noises, facilitated or favored by the resonance of columns of air confined in the meatus.

in the labyrinth is increased by Valsalva. I have, moreover, already observed that a ringing in the ear for which I was consulted, was removed for a long time by a single application of the air douche, as in the following case:

Miss B., æt. 30, has perceived in the left ear for a few weeks past a fine singing or seething, which is continuous, like that of a boiling tea-kettle. The hearing is nearly normal, but somewhat less left than right. The feeling of fulness and tension in the left ear is not pronounced, but the patient often feels as if there were some cotton in the meatus. The *M.T.T.* show nothing abnormal, unless that each manubrium presents itself angularly to view. The air douche gives a weaker auscultation sound than usual in both ears, and is not perfectly continuous. The ringing ceased after one application of the douche, and has not returned a fortnight later. I did not see the patient again.

This was evidently a case of slight catarrh of the middle ear with some contraction of the calibre of the tube, the sequences of which, so far as concerns the middle ear and labyrinth, were removed by the air douche.

Now, Lucae says, explicitly, that the ringing in his ears was perceived chiefly during a pharyngeal catarrh, and it is quite possible that his left tube,* as in my case just cited, was somewhat less permeable than the right, without further functional disturbance. It is now quite generally accepted that during continuous occlusion of the tube, and consequent rarefaction of the air in the tympanum, the tension in the labyrinth is increased by the greater pressure of the *M.T.* (V. Tröltsch *Lehrbuch*, pag. 288). Now, this idea is entirely opposed to the results of Politzer's experiments (*Lehrbuch*, pag. 78), which prove that the fluid in a manometer-tube, inserted into the superior semicircular canal in fresh human ears, *sinks*, when the air in the tympanum is rarefied by suction from the tube outward, and this in spite of increased pressure on the part of the *M.T.*, which is present in as great degree during these experiments as when the tube is continuously occluded.

* The left ear is the first one affected in a majority of cases of otitis med. cat. chron., owing probably to the greater narrowness of the left tube.

Hence we shall be obliged to accept a *diminution of pressure* in the labyrinth, even when the occlusion in the tube is continuous, and referring to Lucae's observations and my own as above cited, I would ask whether diminished pressure in the labyrinth as well as increased pressure might not irritate the auditory nerve. In this way Lucae's two observations of the cessation of ringing in the ears after Valsalva and the air-douche (when the normal tension in the ear is again restored) and the perception of ringing in the ears when the fingers were firmly pressed into the meatus, might be made to harmonize with each other; the latter observation, by the way, is analogous to the ringing in the ear after Politzer's experiment. I have previously communicated an observation which seems to indicate that the pressure in the labyrinth is diminished when the air is exhausted from the tympanum.

The question next naturally suggests itself, *how we are to consider these singing, ringing, seething and chirping noises in the ear in cases of otitis med. cat. chron.*: and, first, whether they are to be considered as a subjective perception like the ringing previously described, or merely as an entotic perception. For many reasons, I should have but little hesitation in deciding in favor of the subjective origin. In the first place, I know of no substratum in the ear or its neighborhood for the auto-perception of so high a tone which would need a continuous source of sound, not merely one that was transitory. The muscular and blood-noises have a deeper character corresponding to roaring, rushing or humming. Next I would point to the relationship with the ringing in the ears described *sub I.* and to the various reasons which I have cited in favor of their subjective origin. I have already remarked that the chirping noise sometimes alternates for a brief period with real ringing in the ears.

The origin of the supposed subjective irritation is at present only a matter of conjecture. If we could confirm the supposition that the auditory nerve responds to mechanical as well as electrical irritation preferably by ringing in the ears, we should be nearer an explanation than before, but should still have to seek the source of the irritation. We

might, perhaps, find it in the current of blood which can produce subjective sensations of light even in the eyes (sparks and flashes), but they are not continuous, and only appear in case of increased excitability. Many signs, such as increased sensitiveness to shrill sounds, augmentation of symptoms after continuous mental labor, etc., favor the view that the auditory nerve is in a state of increased irritability in the cases concerned. I cannot decide whether altered pressure in the labyrinth (increased as well as diminished) or certain pathological alterations alone could cause permanent irritation of the auditory nerve and continuous singing in the ears.

Kessel has called attention to a further possibility in his interesting paper, "On the mobilization of the stapes," (*Arch. für Ohrenheilkde*, Band xiii, pag. 79), where he says: "Chirping may occur when the apparatus of the middle ear is fully preserved, and when the *M.T.* and the first two bones of hearing are lost. We might then attribute its origin to a contraction and tremulous movement of the stapedius muscle, communicating itself to the stapes, resp. labyrinthine fluid, and maintaining a rapid increase of pressure on the nerves, so that a corresponding increase and diminution of the noises would be produced."

Assuming that Kessel means by chirping the same sound that I do, I cannot understand how such a muscular tremor of the stapedius can occur so very frequently in otitis med. cat. chron., and how it can continue permanently for months, and even years, as the noise in question does. I would rather accept Kessel's explanation as suitable for that transitory ringing in the ears which occasionally rises above the chirping or seething, and which is, in my own case, accompanied with a certain feeling of fulness in the ear.

III.

Roaring in the ears, by which I understand a noise like the waving of a river, brook, dam, or waterfall, or the rushing of wind through the branches of trees, is entirely different from the subjective noises hitherto described, not

only in the character of its tone but in its mode of origin. It seems necessary to emphasize this, for although the very sound of the word indicates that roaring (like rushing and moaning) has a decidedly deeper character than ringing, singing, chirping, seething, and hissing, yet they are frequently used interchangeably by physicians and the laity, and the terms snoring, roaring and rushing in the ears, now almost universally applied to all possible subjective and entotic perceptions. I hope, therefore, that no one will take offense if I search carefully into the character of the noise, by comparison with well-known external noises, with tuning-forks and the piano; thus we shall have fewer cases where it will be impossible for us to know exactly what sort of a noise is meant.

I am one of those who regard roaring in the ears (as well as rushing and buzzing) as an entotic phenomenon, as an autoperception of muscular and blood-noises in a large majority of cases. But at the same time I will not deny that it may not also originate in a purely subjective manner in the labyrinth or centres. Still, I believe that I have noticed, *e.g.*, in chronic affections of the labyrinth, that the ringing, singing, and hissing noises are far more prevalent, and I find this confirmed on reading Wolf's paper, "New Investigations, etc."*

The following observations by Preyer, seems worthy of special consideration, as an example of subjective roaring:

Preyer (*loc. cit.* page 71), closed his right ear, and exposed his left ear to the uniform tones of a reed-pipe of 256 vibrations, for eight minutes. When the sound ceased, such a loud splashing was perceived in his left ear, that for a moment he believed there must be some running water near at hand. This noise lasted about a minute, and then all was still in the left ear. He then uncovered the right ear and was astonished to perceive in it a violent rushing sound, which did not die away for at least half a hour. When he repeated the same experiment with both ears open, he perceived the splashing in both ears, (louder, however, in the ear nearer the reed) which lasted a full minute and was followed by a violent rushing sound which

* *Arch. Ophthal. and Otol.*, vol. iv, part 1, page 67; vol. iv, part 2, page 267.

was evidently of a subjective nature. (Central or labyrinthine?) When Schmidekam conducted the strong tone of a siren for a long time directly to his ear by means of a tube, he perceived singing in the ears, with slight vertigo and nausea.

But in most cases, as previously remarked, the rushing, humming and roaring, in a word, the deeper noises in the ear seem to me to be of an entotic nature, originating from blood and muscular noises. Perhaps further observations of the quality of the perception will give us points of support for distinguishing entotic roaring—disregarding the throbbing blood-noises—from noises that are purely subjective. We ought even now in most cases to be able to distinguish the muscular noises. But at present there is more confusion of views than agreement in this subject. Thus Kessel seems wholly to overlook the current of blood as a source of continuous entotic roaring and says (*loc. cit.* page 81): "we have only to show here that the phenomena just cited, humming and rushing of water must be a muscular noise, from the very reason of its unmistakable characteristics, and in all probability can only be derived from the four internal muscles."

This view is again reflected in his attempted classification, where he says (page 78); "If we set aside the common entotic phenomena, the bursting of cysts, the boiling and gurgling of secretions, and the accessory noises, by which I mean those originating in other organs and conducted to the ear, that is to say, from the respiratory, digestive or locomotor apparatus, then in my opinion the other occasional noises are to be *divided into four classes: seething, ringing, humming and throbbing.*"

In this classification I miss the roaring, which is evidently included under humming. If we follow Kessel's view, this is comprehensible and even quite correct, for as he always refers roaring to the muscular noises, the term humming is much more appropriate, and I lay so much the more stress upon this, since Kessel states that he can contract his tensor tympani at will, and then study the noise on himself.

Preyer also calls the *muscular noise of his tensor tympani*, a humming tone, and I believe that we ought to be able in

most cases to distinguish this from the blood-noises by the following points; *a*) the muscular noise never rises above the lowest note of the piano ($a^3 = 27$ double vibrations); *b*) the perception during a muscular tone is less even and smooth, and therefore less agreeable than the tone of a tuning-fork of the same deep pitch (Preyer); according to my own observations also, Preyer's description of the noise as a quite deep humming tone seems very felicitous, and I might add that this deep humming seems to me to have a whizzing or more properly speaking a fluttering character; *c*) finally the muscular noise, according to its origin, is not so evenly continuous for so long a time as the roaring or rushing originating from the current of blood. A muscular noise (associated movement of the tensor tymp.) is heard when we yawn; if further we close both ears firmly with the palms of the hand, while the elbows rest on a table, we hear a rushing noise mingled with a humming, which is usually regarded as a muscular, but which I believe to be the current of blood, the perception of which is formed by the resonance of the closed meatus; this noise does not seem to me to have exactly the same character as the muscular noise heard when we yawn.

The roaring caused by the movement of the blood is sometimes throbbing, isochronous with the wave of the blood, sometimes even in its flow, depending on its origin.

Under normal circumstances, we do not hear the movement of the blood in the ear or its neighborhood. Amongst the favoring circumstances we may mention; *a*) all those factors which strengthen the *resonance in the ear** such as seclusion of air in the meatus or tympanum, or mastoid cells, or elsewhere near the ear; or collections of fluid in the tympanum or meatus, (*e.g.*, a drop of water remaining in the sinus in front of the *M.T.* after syringing, may cause roaring.) We know that under these circumstances the tone of a tuning-fork resting on the cranium is strengthened, and a similar reinforcement is to be expected in the case of the blood-noises; unfortunately we do not yet sufficiently understand the relations of resonance in healthy and dis

* Or on the whole favor the conduction of noises to the nerves.

eased ears, resp. the mechanism for its prevention. Just here I will remark that when we touch a diseased ear or its neighborhood, many patients perceive a hollow tone, very different from that heard when the healthy ear is touched. We must bear this in mind, when roaring in the ear is present in any given case. *b) abnormal reinforcement of the blood-noises* whether from increased activity of the heart or local disturbances in the circulation. *c) hyperaesthesia of the auditory nerve*, or of the nervous central organs. The three chief causes may combine with one another, as is probably the case in most of the throbbing noises following acute inflammatory affections of the middle ear, where the bone conduction on the affected side is permanently and greatly reinforced.

I would classify the noises in cases of tightly fitting plugs of cerumen, as well as those due to the obstruction from polypi, or when the tympanum or meatus is filled with secretion, under letter *a*). When we press the ear (with the auricle folded over the meatus) against a firm sofa-pillow, we hear a throbbing, rushing noise, which also belongs to this class. If we close the meatus with the finger, the continuous noise that follows assumes more of a humming character, as the vascular noises are then mingled with muscular noises.

The following observation by Gruber (*Monats. für Ohrenheilkde.*, 1877, No. 8) seems to me of interest:

The posterior upper portion of the *M.T.* of a student with one-sided violent and continuous tinnitus, with defective hearing, was found very much atrophied and usually resting against the incudo-stapedial articulation, while it bulged forward like a vesicle when air was forced in. After Gruber had destroyed the atrophic portion (2 mm. diam.) with the galvano-cautery, the tinnitus ceased, and did not reappear when the opening healed. I suspect that the tinnitus (not further qualified as regards pitch, etc.) was due to the *M.T.* resting against the stapes, and direct conduction of the blood-noise to the labyrinth; possibly also to the seclusion of an air-chamber in the posterior portion of the tympanum, although this idea seems but slightly probable. Unfortunately we are not told whether the tinnitus was also stopped when air was

forced against the atrophic portion, and nothing is said about the state of the bone-conduction.

Cases of entotic roaring, due solely to the factors cited under *b*), without alteration in resonance or conduction are less frequent. It is well known that transitory rushing in the ear can be perceived during violent excitement of the vascular system from either physical or psychical causes; but I cannot venture to decide whether the rushing in the ears during faintness belongs to this class, or is to be regarded as a subjective phenomenon dependent upon a central irritation. We have an interesting example of entotic rushing in the ear from local disturbances of the circulation in a case published by Moos,* "On a case of enlargement of the bulbus venæ jugularis cerebialis." We learn from the subsequent discussion that Oppolzer explained the tinnitus in chlorotic patients as an autoperception of the *bruit de diable*, because it disappeared when the jugularis was compressed, as Prof. Friedreich had found in some cases, in others not. Boudet also, as cited by Moos, had as early as 1862 explained the rushing in the ears in many cases as due to conduction of the anæmic bellows-murmur in the jugularis through the bone to the auditory nerve; as the point of entrance of the lateral sinus into the jugular fossa is very narrow in comparison with the dilatation immediately following, a bellows-murmur here originates, for the production of which a certain rapidity of the current beneath the contracted spot is necessary. Moos thought that this theory would not apply to so many cases as Boudet believes, and I fully agree with this view. I imagine that such a hammering noise in the bones of the skull, and so near to the ear, must be extremely intense and distressing. We ought also to be able to demonstrate it objectively by auscultation, and amongst other points must study the influence of compression of the cervical vessels upon the noise, and yet, when we consider the situation of the vena jugularis interna, near to and above the carotid, an isolated compression of the former would meet with difficulties.

* *Archives of Ophthal. and Otol.*, vol. iv, parts 3 and 4, page 478.

IV.

The subjective hearing of *connected melodies** forms a particular group of subjective perceptions of sound, as well in its mode of origin as in the quality of the sensation. It is plain that we have here to deal with a more central symptom. Can affections of the labyrinth alone produce it? So far as I can discover in literature and from my own observation, this phenomenon is by no means regularly associated with diseases of the labyrinth, and if it appears exceptionally, we may ask if it may not be caused by a simultaneous irritation of the portion of the brain concerned.

Theoretically also it seems to me as if we cannot seek the cause in the labyrinth, and a physiologist to whom I submitted the question, replied: "I can answer your question very decidedly, by saying that it is impossible for the hearing of connected and arranged melodies to have a peripheral cause, as, *e.g.*, in the labyrinth or cochlea. The cause cannot even be sought for in the nearest auditory centres, and at all events only in the region of the cerebrum."

These reflections have a decidedly practical interest, as the following case proves:

Transitory deafness, with subjective hearing of connected melodies after large doses of quinia.

Mrs. S., æt. 35, whom I treated for otitis med. cat. chron., told me that three years ago, in childbed (tedious labor with subsequent puerperal fever), she had to take five large doses of quinia, from which she became so deaf for two days that she could not hear her own voice, and had the greatest difficulty in hearing those about her. All sorts of noises were at the same time perceived in the ears: tones, roaring, singing, etc., but she chiefly heard connected melodies, so that she could not get rid of the idea that some one was playing on the piano in the room above

* Subjective perception of real musical tones was first observed by Moos, and explained as a purely nervous affection of single nerve fibres of Corti's organ. Gerny and Samelsohn made similar observations at a later date, which agree with the explanation offered by Moos. The collected observations were published in Virchow's *Archiv*.

her. The melodies were always the same, and entirely strange to her. This condition lasted two or three days, when the subjective phenomena and extreme deafness gradually disappeared, the hearing recovered slowly during three or four weeks, and the patient believes that it was then as good as ever before, although this could not be accurately confirmed. Since then she has had continuous roaring (in the left ear especially), sometimes more violent, sometimes weaker, and often disappearing for longer or shorter periods. The symptoms, as above described, ensued directly after the first two powders in the forenoon, but only became violent when the other three doses were given at evening. Quinia has since been ordered for her, but in smaller doses, and has always been followed by roaring in the ears, but without any perception of the former subjective phenomena.

The sudden appearance of the symptoms after the first two doses, and the remarkable reinforcement of all the phenomena after the three following, proves that these were due to the action of quinia, especially when we consider that affections of the organs of hearing after puerperal processes are, so far as we know, of a different character, and particularly less transitory. It has lately been affirmed that quinia acts on the ear from the labyrinth outward, although exact proof of this (*e.g.*, demonstration of quinia in the labyrinthine fluid) has not yet been given; in the eye also, which, although less violently and less easily affected than the ear, no one has yet demonstrated any ophthalmoscopic condition,* and it seems more probable that quinine-amblyopia has a central cause. Or, again, the action of quinia may be double, at once central and peripheral, and the case just reported offers distinct proof in favor of the former of these views.

As the disturbances may last for weeks and months—we have reports of permanent disturbances of hearing and vision, as well as paralysis—we must imagine that the quinia absorbed by the blood causes changes in the nervous elements of the brain, which are usually transitory, but occasionally permanent. The numerous coinciding observations

*Observations to the contrary, see in a paper by Roosa, *Arch. Ophthalm.*, ix, No. 1.—K. Ed.

of ringing and rushing in the ears as the symptoms after the exhibition of quinia or salicylic acid, seem also of interest, although we do not know where and how they originate. In the meantime, we shall have to consider them as central phenomena. We might imagine the rushing to have some connection with the action of quinia on the vascular system, and to be of an entotic nature. Large doses of quinia, as is well known, lower the arterial pressure and diminish the frequency of the pulse, while small doses act inversely.

Subjected hearing of connected melodies after cerebral apoplexy.

I owe the following notes to the kindness of a patient who consulted me some years previously for deafness from which he had suffered since youth. I found at that time the remains of otitis med. cat. chron. in both ears, and sclerosis of the mucous membrane of the tympanum. The deafness was so extreme in the left ear that I had to assume a secondary affection of the labyrinth. Hearing in the better ear, *R.*, watch, $\frac{1}{8}$ to $\frac{1}{16}$ cm., conversational tone when close to the ear. I declined to treat him. A year ago the patient, then aged about 40, had an apoplectic attack with complete hemiplegia, partial aphasia, and total deafness; he could not hear his own voice. The aphasia disappeared in a short time, and the paralysis improved so much in a year that he could walk with the help of a cane, but the paralyzed leg still drags, and he has not much power in his arm. The hearing improved least of all, so that the patient is forever debarred from verbal intercourse. In the first two or three weeks after the attack he frequently heard melodies as if from a hand-organ, which became so unendurable, so intense and so deceptive that he often would beg his wife to drive the organ-grinder from the house. Roaring was not present at first, but it appeared for a while at a later period, and then disappeared; he still hears ringing in the ears occasionally. The patient mentions as a remarkable phenomenon that, in spite of his deafness, certain high tones (such as the scream of a parrot, which he had to remove from his room) cause a disagreeable and painful sensation.

Similar observations of *hyperæsthesia with complete deafness* have led Politzer (*Lehrbuch*, pag. 229) to assume "that

there is a second set of fibres in the auditory nerve, which, like the others, is only excited by vibrations, but which does not respond with a perception of the vibration, but with a peculiar sensation of pain." Setting aside the probability of such a view, I do not regard it as necessary, for other organs of special sense react painfully upon too violent irritation, although no one, so far as I know, has ever deemed such an hypothesis necessary for its explanation.* Our case was evidently one of paralysis of the central auditory organs, with simultaneous hyperæsthesia of the otherwise unaffected portion, and hence it is not surprising if the sensation of sound was not perceived with the disagreeable impression. The supposition of an excessive hyperæsthesia of the central organ seems sufficient to explain the other cases, and it would be interesting to observe whether the painful sensation only appears in cases of high tones. Nor is it strange that the auditory nerve can be excited from the periphery even in seemingly complete deafness; we have only to assume that the labyrinth is still partially capable of functioning. In our case, moreover, the extreme deafness was not so total, but that some perception of sound by the bones still remained, for the patient discovered of himself that when he held a bunch of keys between his teeth he could just hear their clinking.

The subjective hearing of complete melodies in cases where the clinical picture shows original peripheral disease (otitis med. cat. chron.), is less easy to explain.

I recall to mind two such patients, both of whom were very musical. The symptom first showed itself in both after the original slight deafness had increased to total deafness in the course of more than twenty years. Both were in the prime of life, and bodily and mentally sound, excepting their deafness. One of them, Mr. S., who had been treated during his travels by most of the German aurists, was so deaf when I last saw him that he could not hear the trace of a sound when playing the piano, not even the strokes of the keys, or his own voice; bone-conduction was

* The cause of this is rather to be sought for in the central organ itself than in two sets of fibres of the nerve of sense. Moos ("Ueber den Zusammenhang zwischen Krankheiten des Gehörorgans und solchen des Trigeminus.") Virchow's *Archiv*, 1876, explains these phenomena as sensations of touch.

also lost. On the other hand, he told me that lately he had often heard the most lovely, subjective, peculiar noises, with which he could fill volumes. Most of these were in the major keys, but occasionally in the most striking minor keys. Two year ago he could still hear his own voice at times, as if from a distance, and on very favorable occasions the forcible note of a piano, as well as the tone of a prismatic C^1 fork, and more clearly by bone-conduction than by the ear. He could no longer hear conversation with the speaking-tube. I mention as a curiosity that he was often relieved by laying a mustard-paper on the neck, so that he could hear his own voice for a whole day; this transitory improvement was noticed for some time, but by and bye the mustard-paper gave him no relief. He regarded a fine hissing in his ear as a bad symptom, and a deep rushing as a good one.

As the assumption of a secondary affection of the labyrinth is not sufficient, in my opinion, to explain the subjective sensations in such cases, we have to imagine that changes gradually ensue in the centres of the auditory nerve, and even in the cerebrum (probably from absence of the customary peripheral irritation), and cause an abnormal irritative condition at that situation.

THE NEW "FOLDING DENTAPHONE,"*

BY CHAS. S. TURNBULL, M. D., PHILADELPHIA.

This new instrument, called the Folding Dentaphone, in contradistinction to the "Watch Detaphone" described in the last issue of these Archives, is the latest offered by the American Dentaphone Co., of Cincinnati, Ohio. It overcomes one of the most serious objections urged against the "Rhodes Audiphone," in that it is portable since it can be folded up and conveniently carried in the pocket. It answers every requirement and will, for the time being at least, supplant all similar instruments heretofore devised.

Sensitive persons, and most deaf people are exceedingly sensitive, seriously objected to the Audiphone on account of its being so cumbersome. A lady might carry it on the pretext of having a fan in hand, but the universal wish of all, who might to any degree be benefited by the employment of such an instrument was for some convenient place to carry such a fragile and cumbersome companion. To be impartial, we state the claims of the inventor of the "folding dentaphone," especially as our experience and experiments justify them. They are, portability; the transmission of sound vibrations with marked clearness and distinctness, and the power of intensifying sounds transmitted. A description of the instrument is not necessary as the accompanying cut illustrates it perfectly, but suffice to say, the diaphragm is made of thin sheet vulcanite which folds

* In Dr. Turnbull's paper on the Audiphone and Dentaphone, (these ARCHIVES, vol. viii, p. 373, etc.,) several passages were quoted from the circulars of the manufacturers of these instruments. The quotation marks were omitted by the type-setter and overlooked by the proof reader and editor. As the paper was sent in just at the close of the volume, a proof could not be forwarded to the author.

H. KNAPP.

twice upon itself. When in use a piece of rubber cord, caught upon a pin in the handle, holds the folding sides in position. In adjusting the instrument the hinges are turned to the inside, and it is not curved by strings from fixed

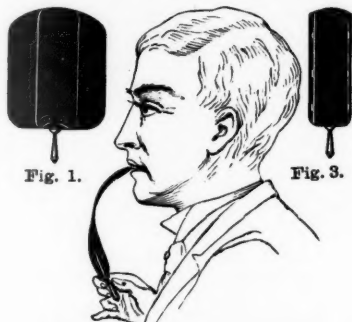


Fig. 1 represents the Dentaphone as it appears when used as a fan; in Fig. 2 it is seen in position against the teeth of the deaf person using it; and Fig. 3 shows it folded up to be inserted in the pocket, or otherwise carried when not in use.

points, as in the audiphone, but is bent into any suitable curve by pressure from the handle toward the teeth, as we suggested in our last communication. The smaller size (for conversation) is $9 \times 7 \frac{1}{2}$ inches and the larger (for lecture or concert) 11×8 inches is proportionately stronger.

SOME OBSERVATIONS CONCERNING THE VALUE OF THE AUDIPHONE.

By H. KNAPP.

THE extravagant expectations which the fanciful announcements of the "marvelous invention of the audiphone" had awakened in the minds of both physicians and patients, have soon and sadly been disappointed. The principle on which the instrument is based is well known, and numerous examples have long been on record of deaf persons hearing music quite well when putting their head on a piano, or holding one end of a stick between their teeth while the other end rested on the piano. The novelty of the audiphone, dentaphone and similar instruments lies in the application of a solid plate as a sound receiver, the vibrations of which are transmitted to the teeth either directly or, in the manner of a telephone, by means of a string. The sound waves which strike the skeleton parts of the skull can, according to E. H. Weber and all later investigators, be transmitted to the sound-perceiving terminal apparatus of the acoustic nerve, either *directly* through the petrous bone, or *indirectly* through the membrana tympani and the chain of ossicles, or in *both* ways conjointly. The question which was formerly much discussed, viz.: whether sound waves can be transmitted to the expansion of the acoustic nerve in the cochlea directly from the bone, without any participation of the conducting apparatus of the middle ear, has been answered affirmatively by the experiments of

Lucae* and Politzer.† Politzer states ‡ that there are cases in which loud words are understood by the patient when spoken near his head, but not through a hearing trumpet. I must confess that I have never come across such cases, though I am far from doubting their existence, and have, as everybody, frequently met with patients to whom words spoken in a trumpet were so disagreeable that they preferred not using an instrument at all. Patients of these two classes, and only these, can derive more benefit from the audiphone than from a trumpet. Although my observations with special reference to this point are still limited, I express my opinion without hesitation or reserve that such cases are very rare.

Leaving aside all theoretical considerations, the practical value of the audiphone, dentaphone, and all contrivances that are based on the sound-conduction of the cranial bones, and which Dr. C. H. Thomas of Philadelphia, appropriately calls osteophones,§ can be decided by two questions: 1st, does a partially deaf person hear better with an osteophone than when directly spoken to; 2d, does he hear better with an osteophone than with an ear trumpet? According to my experience I have to answer the first question affirmatively, the second negatively.



G. TIEMANN & CO. N.Y.

For a few months I have examined all my private patients that were very hard of hearing, for only such will use instruments, both with a Rhodes' conversation audiphone and a dipper-shaped ear trumpet, (see accompanying figure). The mouth-piece of this trumpet, covered with a perforated

* *Arch. f. Ohrenhkde.*, Bd. I, (1864) p. 308, etc. † *Ibidem*, p. 319, etc.

‡ *His Lehrbuch der Ohrenhkde.*, I, p. 214, (1879).

§ *Philadelphia Med. Times*, February, 1880,

metal plate, has an aperture of 120 *cm.* (4.5"). Its parabolically curved bottom has a diameter of 75 *cm.* The depth is 100 *cm.* The sound-waves reflected from the parabolic bottom are collected in its focus over which the broad curved end of the neck of the instrument expands in such a manner that all the reflected waves are conducted into the patient's ear.

The abstracts of the subjoined fourteen cases will suffice to illustrate the comparative value of the two instruments under different conditions.

CASE I.—Mr. S. S.—, æt. 50. *Otit. med. cat. chron.*¹ —*H*² for ten years or more. Pharyngitis, tinnitus, vertigo. Both *Mt* whitish, sunken, *R* tube open, *L* closed. No improvement of *H* by inflation. *h*=0, both sides. Pol. acoum, *R* 0, *L* 1". Bone-conduction for low-ticking watch 0, for other instruments good. *V* *R* $\frac{1}{6}$, *L* $\frac{3}{6}$, (no lip reading). With audiphone, *V* 10'; ear trumpet, *R* 10', *L* 15'.

The conditions of this case are favorable for the use of the audiphone. The patient also heard considerably better with it, yet not so well as with the trumpet, and he stated without being asked that he heard louder and more distinctly with the trumpet than with the audiphone.

1. The disease, in all cases, was on both sides.

2. ABBREVIATIONS:

<i>H</i> = acuteness of hearing.	<i>V</i> = <i>H</i> for ordinary voice, intelligible at 60'.
— <i>H</i> = diminution of <i>H</i> .	<i>v</i> = <i>H</i> for whispering voice, intelligible at 20'.
<i>mt</i> = membrana tympani.	<i>h</i> $\frac{1}{2}$ = watch heard on contact with the ear.
<i>mtt</i> = membranæ tympanorum.	<i>h</i> 0 = watch not heard on contact with ear.
<i>R</i> = right, or right side.	<i>V</i> $\frac{1}{2}$ = loud voice heard, but not understood, <i>i. e.</i> quantitative perception of sound.
<i>L</i> = left, or left side.	<i>V</i> 0 = Voice not heard at all.
<i>h</i> = (horologium) = <i>H</i> for watch.	
Pol. acoum. = <i>H</i> for Politzer's acoumeter.	

Bone-conduction is expressed as follows:

h $\frac{1}{2}$ (mastoid) = watch heard when pressed on mastoid.

h 0 (mast.) = watch not heard when pressed on mastoid.

h $\frac{1}{2}$ (temple) or *h* 0 (temple) = watch heard, or not heard when pressed on temple.

h $\frac{1}{2}$ (forehead) or *h* 0 (teeth), etc., are easily understood.

The same: Pol. acoum. $\frac{1}{2}$ (mast.) or 0 (forehead), and *F*, *i. e.* furca musica, tuning-fork $\frac{1}{2}$ (forehead), etc., need no special explanation.

I will further state that the tick of my watch is heard at a distance of 24', and Politzer's acoumeter at a distance of about 45' or 15*m.*

CASE 2.—Mr. C. S., æt 30. *Otit. med. cat. chron.* No hereditary tendency to deafness. Tinnitus. Pharyngitis. Tubes strictured. *Mtt* thickened, dull, sunken, handles drawn forcibly backward. On Sigle, only a slight motion of handle, *h R* $\frac{1}{16}$, faint; *L* $\frac{1}{16}$. Bone-conduction for watch only on left mastoid. *F* (tuning-fork) by air and bone-conduction from all places of head, well. Pol. acoumeter $\frac{1}{3}$ " each, well in contact with bone and teeth. *VR* $\frac{1}{16}$, *L* $\frac{1}{16}$. Audiphone $1\frac{1}{2}$:60; Trumpet, *R* $\frac{1}{16}$, *L* $\frac{1}{16}$. Speaking-tube a whisper.

In this case the bone-conduction was reduced in about the same proportion as the hearing through air. The advantage of the trumpet over the audiphone was marked.

CASE 3.—Mrs. W. H. M., æt. 63. *Otit. med. cat. chron.* Had erysipelas thirty-seven years ago, producing deafness which disappeared again. Subject to colds. *H* very gradual for thirty years. *Mtt* moderately sunken. Her teeth are very good, *h=0*. No bone-conduction for watch. Feels the strokes of Politzer's acoumeter, does not hear its sound. *V* $\frac{1}{2}$:60. With audiphone the same, with parabolic trumpet, *V* $\frac{1}{16}$.

Whether the absence of bone-conduction, common in old age, was the cause of the inefficiency of the audiphone in this case or not, I leave undecided. The examination of numerous cases of this kind may lead to results not without importance.

CASE 4.—Miss C. C., æt. 22. *Chron. aural catarrh.*—*H* 7 yrs. Tinnitus. Posterior wall of pharynx cicatricial. *Mtt* dull, sunken, irregular. Inflation with catheter difficult. No improvement of *H* after Politzer's method. *h R 0*, *L* $\frac{1}{16}$; *V* from $\frac{1}{16}$ to $\frac{1}{16}$ each. Audiphone, (good teeth) *V* $\frac{1}{16}$; trumpet, $\frac{1}{16}$, each.

Though the bone-conduction in this young patient was perfect, and the physical examination makes the presence of adhesions in the tympanic cavity very probable, the trumpet produced a greater increase of *H* than the audiphone.

CASE 5.—Mr. A. F., æt. 48. *Chron. Otit. med. cat.*—*H* $2\frac{1}{2}$ yrs. Frequent colds in head. Pharynx cicatricial. Tubes strictured. *Mtt* sunken, handles drawn back and up so that tips are above

horizontal plane. Bone conduction *R* absent, on *L* side of head good. *h* $\frac{1}{2}$ *o*, $L \frac{1}{2}$; *V R* $\frac{3}{8}$, improved by Politzer; *L* $\frac{1}{8}$, not improved. Audiphone, $\frac{1}{8}$; trumpet, $\frac{3}{8}$.

Though a four weeks' treatment raised *H* to $\frac{3}{8}$ so as to render acoustic appliances for the present unnecessary, I consider this case one of incurable progressive hardness of hearing, requiring trumpets later.

CASE 6.—Miss C. L., æt. 9. Semi-deafmute. *Otit. med. adhes.* Was a very weak child, but not ill. Began to speak only when 5 years old. Body well developed. Teeth good. *Mtt* sunken, uneven, apparently thickened, handles drawn back. *h*? *V*. $\frac{1}{8}$ each. Audiphone, $1\frac{1}{2}$:60; parabolic trumpet, *R* $\frac{1}{8}$, *L* $\frac{6}{8}$.

It is questionable whether in this case the middle ear disease was complicated or not with a labyrinthine or nervous affection. The young patient derived little benefit from the audiphone, but great benefit from the trumpet, which for the education of speech and the development of what hearing power she had I strongly recommended.

CASE 7.—Miss A. B., æt. 38. *Chron. aur. catarrh.* Deafness in family. —*H* 5 years, gradual. Pharynx pale, dry. *Mtt* sunken. Tinnitus. *h* *o* and no bone-conduction on either side. *V R* $\frac{5}{8}$, *L* $\frac{5}{8}$. Audiphone, (teeth artificial, well fitting) $\frac{5}{8}$; trumpet, $\frac{3}{8}$.

CASE 8.—Mrs. F. B. C., æt. 29. *Chron. aur. catarrh.* Conditions common. *h R* *o*, no bone-conduction. *L* $\frac{1}{2}$, no bone-conduction for low-ticking watch. *V R* $\frac{1}{8}$, *L* $1\frac{1}{2}$:60. Audiphone, $\frac{4}{8}$; trumpet, $\frac{3}{8}$.

CASE 9.—Miss I. M., æt. 20. *Chr. aur. catarrh.* *Mtt* fairly normal. *h* $\frac{1}{2}$ on ear, mastoid and temple, not on forehead. *V R* $\frac{4}{8}$, *L* $\frac{5}{8}$. Audiphone, $\frac{5}{8}$; trumpet, $\frac{3}{8}$.

CASE 10.—Miss J. H., æt. 31. *Chron. aur. catarrh.* *h* $\frac{1}{2}$. Bone-conduction good. *V* $\frac{1}{8}$ each. Audiphone, $\frac{3}{8}$; trumpet, $\frac{4}{8}$.

CASE 11.—Miss S. B., æt. 10, *Ot. med. pur. chr.* Had symptoms of hereditary syphilis when born, scarlet fever when six weeks old, otorrhœa ever since, keratitis parenchymatosa heredito-syphilitica two years ago; lately a perforating ulcer of hard palate,

and extensive irregular ulcers on soft palate. After several months treatment, condition of pharynx, cornea, ears (which show large defects of *Mt*), and general health materially improved. Tubes pervious. Watch heard on application to ears and teeth, not to cranial bones. Tuning-fork heard by bone-conduction. Pol. acoumeter $\frac{1}{2}$ " and $V R \frac{4}{80}$, $L 1\frac{1}{2}:60$. *H* slightly improved by trumpet, not so much by audiphone.

I have mentioned this very complicated case only in order to show that in it neither audiphone nor trumpet had an essential effect on *H*.

CASE 12.—Mrs. E. D. æt. 48. Nervous deafness. —*H* 10 yrs., gradual. No heredity. Ten years ago, after confinement, had chills, and took great quantities of quinine, which always diminished *H*. Pharynx fairly normal; tubes open; *Mt* slightly sunken at centre, white at periphery. $R h = \frac{1}{8}$, faint. $L h = 0$ (on all places of the head). $R h = \frac{1}{8}$ (forehead and teeth). *FR* well by air- and bone-conduction, L not at all. $V R \frac{1\frac{1}{2}}{80}$, $L \frac{1\frac{1}{2}}{80}$. Audiphone, $1\frac{1}{2}:60$; trumpet, $\frac{6}{80}$. Through flexible speaking tube she hears a whisper.

The history of this case, the absence of marked changes in the conducting apparatus, the greatly reduced bone-conduction, the very small increase of *H* by the audiphone, and the great increase by trumpets, seems to indicate that the deafness in this case was chiefly produced by an affection of the inner ear and the acoustic nerve.

CASE 13.—Miss M. H., æt. 48. *Otit. med. adhesiva et otit. interna chronica*. Thirteen years ago, after sleeping near an open window on the sea-shore, became very hard of hearing. Was under skilled treatment; *H* improved at first, then gradually diminished. Pharynx fairly normal; tubes open. *R Mt* white, irregularly striped. L sclerosis, the bare promontory being felt with probe in centre, fibrous tissue at periphery. No ossicles visible; $h = 0$, each. No bone-conduction for watch on either side. Politzer's acoumeter placed on bone perceived as knocks, not as sound. Tuning-fork only by air-conduction on right side, not from bones. $V L = 0$, $R \frac{1\frac{1}{2}}{80}$. Speaking tube in L not heard, in R plainly. Audiphone, $V \frac{1\frac{1}{2}}{80}$; dipper trumpet $\frac{2}{80}$.

For years marked spells of headache, dizziness, nausea, vomiting, tendency to fall forward. Tinnitus constant, varying in intensity.

In this case of, as it seems, complete deafness on one side, and great hardness of hearing on the other, in both from evident grave disease of the middle ears with implication of the labyrinth and abolition of bone-conduction, the audiphone produced no effect, the trumpet a decided increase of *H*.

CASE 14.—Mrs. G. S. æt. 24. *Otit. med. cat. et interna chronica heredito-syphilitica*. Of this important case, the full report of which I reserve for another occasion, I will here mention only what follows. *HR* $\frac{1}{16}$, *L* 0. No bone-conduction. Pol. acoum. *R* $\frac{1}{2}$ ", *L* 0; on bone everywhere, better on *R* than on *L* side. Tuning-fork *R* only; by bone conduction only from the teeth, well in *R*, scarcely in *L*. *V* *R* $\frac{6}{10}$, *L* $\frac{14}{10}$. Flexible tube *R* whisper, *L* strong voice. Audiphone $\frac{5}{10}$; parabolic trumpet *R* $\frac{1}{10}$, *L* near by.

In this case no improvement of *H* by the audiphone, but a marked improvement by the trumpet.

In order comprehensively to review the results of the foregoing observations, I have arranged the cases in a table in such manner that *V* (the acuteness of hearing for ordinary voice), determined without the use of an instrument is taken as 1, and *V* determined by the aid of the audiphone and the trumpet is so computed as to represent its proportion to 1. The table therefore shows how many times the audiphone and the trumpet increased the acuteness of hearing of the patients examined.

HEARING ACUTENESS FOR LOUD VOICE.

NO.	WITHOUT AN INSTRUMENT.	WITH THE AUDIPHONE.	WITH THE EAR TRUMPET.	DISEASE.
1	1	5	7	Chron. aur. catarrh.
2	1	1.5	6	" "
3	1	1	3	" "
4	1	5	8	" "
5	1	5	7	" "
6	1	3	20	" "
7	1	2.5	10	" "
8	1	2.7	13.3	" "
9	1	1.2	4	" "
10	1	2	4	" "
11	1	1.2	1.4	Otit. med. pur. chron.
12	1	3	12	Nervous deafness.
13	1	1	2	{ Chron. inflammation of middle and inner ears.
14	1	1	3	

The table shows that the Rhodes' *audiphone* produced no increase of the acuteness of hearing in 20 per cent. of the cases, a slight increase (from 1.2 to 1.5 times) in 20 per cent., a moderate increase (from 2 to 5 times) in 60 per cent., whereas the *dipper-shaped ear trumpet* produced an increase of the acuteness of hearing in all cases, slight in 8 per cent., moderate (from 2 to 5 times) in 35 per cent., and great (from 6 to 20 times) in 58 per cent. The audiphone, therefore, is not a useless instrument. It increases, in a moderate degree, the hearing power of the majority of very deaf persons; in every case, however, as far as my examinations have gone, was its value exceeded, and in most cases greatly exceeded, by the ear trumpet.

The above cases are not the only ones in which I have tried the audiphone. The general result in all was the same. Other impartial observers have tested the audiphone and found that it falls far short of what its inventor claimed for it. Since the statements of these observers are, as far as I know, expressed only in general terms, I thought that the above quantitative determinations, limited though they be in number, might not be read without interest. Further study of this subject is not without promise, both in a physiological and a practical point of view.

REPORT OF THE PROGRESS OF OTOLOGY.

IN THE LAST THIRD OF THE YEAR 1878.

EMBRYOLOGY AND COMPARATIVE ANATOMY OF THE ORGAN
OF HEARING AND THE NASO-PHARYNGEAL SPACE.

By L. LOEWE, BERNE.

Translated and condensed by Dr. E. S. Peck, New York.

1. v. GRABER : Ueber neue, otocystenartige Sinnesorgane der Insecten. [New, ear pouch-like organs of sense of insects.] *Archiv f. micr. Anatomie*, vol. xvi, part 1, p. 36-57. Two plates.
2. v. HENSEN : Bemerkungen gegen die Cupula terminalis (Lang). [Observations on the Cupula terminalis.—Lang.] *Archiv f. Anatomie u. Physiologie*, 1878, vol. vi, p. 482-486, with one plate.
3. C. CLAUS : Ueber den acustischen Apparat im Gehörorgan der Heteropoden. [The acoustic apparatus of the heteropoda.] *Archiv f. micr. Anatomie*, vol. xv, part iii, p. 341-348, with one plate.
4. ALBAM H. G. DORAN : Morphology of the mammalian ossicula auditus. The transactions of the Linnæan Society of London, 1878, vol. ii, part 1, p. 371-497, with seven plates.
5. M. FLESCH : Die Anwendung von Gemischen der Chromsäure und Osmiumsäure zur Untersuchung des Gehörorgans kleinerer Thiere. [The combination of chromic and osmic acids in the examination of the apparatus of hearing of lower animals.] *Archiv f. micr. Anatomie*, vol. xvi, part 2, p. 300.
6. E. ZUCKERKANDL : Zur Anatomie und Entwicklungsgeschichte der Naso-Ethmoidalregion. [Anatomy and development of the naso-ethmoidal region.] *Wiener med. Jahrb.*, 1878, vol. iii, p. 301-328, with two plates.
7. v. URBANTSCHITSCH : Beobachtungen über die Bildung des Hammer-Amboss-Gelenkes. [Observations in regard to the formation of the malleo-incudal articulation.] *Schenk's Contributions*, 1879, vol. iii, p. 229-233, with one plate.

8. P. ALBRECHT: Ueber einen Processus odontoides des Atlas bei den urodelen Amphibien. Vorläufige Mittheilung. [An odontoid process in tailed amphibious animals; a preliminary contribution.] *Centralbl. f. d. med. Wissensch.* Nos. 32 and 39.

9. L. LOEWE: Beiträge zur Anatomie der Nase und Mundhöhle. [Contributions to the anatomy of the nasal and buccal cavities.] Berlin, 1878. (Denicke.) Folio, 21 pages, and seven plates.

10. URBAN PRITCHARD: The development of the organ of Corti.] *Journ. of Anat. and Physiol.*, vol xiii, part 1, 1878, p. 99-103, with one plate.

11. RETZIUS: Zur Kenntniss von dem membranösen Gehör-labyrinth bei den Knorpelfischen. [Inquiry into the membranous labyrinth of the ear in cartilage-fishes.] *Archiv f. Anatomie u. Physiologie, section of anatomy*, 1878, vols. ii and iii, p. 83-107, with one plate.

1. GRABER found new auricular-like organs of sense at the terminal joint of the antennæ of certain flies (*Sicus ferrugineus*, *Helomya*, *Syrphus balteatus*). He found also a peculiar cerebral nerve of sense, a pouch consisting of a cellular layer, and a capsule provided with extraordinarily fine, easily movable hairs. The true otolith was deficient. When it is remembered that the deposition of lime salts does not take place in the otoliths of certain mollusca; and further, that the auricular pouches of crabs contain no stones; the persistent absence of these otoliths can in no way operate against the explanation of these organs as true otocysts, * * * * The auditory pouches of crabs lie in the distal member of the feelers, while those of insects lie in the third section; so that the obvious dissimilarity of certain members of the extremities makes it possible, that the sensitive region of flies, extending over three members, corresponds to the distal member of the antennæ of the crab. These organs are wanting among those arthropoda, which form the link between the higher order of crabs and insects. It will be a problem of future inquiry to prove experimentally the physiological import of the otocysts of antennæ, and how far they are associated, biologically and genetically, with simpler conditions, especially with the involution and gradations of integument.

GRABER also describes another new organ in a maggot-fly, as

contributing to the function of hearing. It is a transparent pyriform pouch of 0.3 mm. in length, whose free head is directed forward, while the pointed end extends backward in a narrow cylinder. This pouch is large enough to be seen with a weak magnifying lens on the bright background. The construction of this organ is very peculiar. One sees the pouch proper with its cylinder, and the nerves and muscles connected with its anterior part. The pouch with its terminal cylinder resembles a diverticulum or involution of the skin.

2. HENSEN failed to find a *cupula terminalis* in the gudgeon.

3. Besides the large central cell, CLAUS found a great number of smaller hair cells, arranged concentrically, which corresponded to Ranke's ganglion cells. The broad space between the central cell and outer hair cells was occupied by four large isolated or supporting cells.

4. DORAN describes the ossicula auditus of different animals and man in the rich collection of the Museum of the Royal College of Surgeons, London, from a comparative standpoint. The head of the malleus compressed in its antero-posterior diameter, and expanded laterally, rises considerably above its articulation, and juts outward. The oblique position of the articulation on the posterior portion of the head gives its external border a higher position than its internal. A shallow furrow separates the two facets of the so-called "saddle-shaped" joint, running parallel with its oblique long axis. The inner and upper half of the saddle above this furrow corresponds to the articular facet, which in animals lies above; the outer half below the furrow corresponds to the inferior facet of animals. Both articular facets are convex at their peripheral borders, and face away towards the furrow of separation, so that viewed laterally the two facets seem to enclose a concavity.

The neck of the human malleus is shorter than that of most mammals, longer than that of the primates. A sharp S-shaped crest lies upon its outer upper surface, which begins near the anterior border of the articular surface, and is lost in the root of the hammer-handle. This crest corresponds to the sharply bent neck of the carnivora, ruminantia, and many other mammalia, in which a bony lamella extends from the region of the neck to the end of the processus gracilis. The human foetus exhibits a trace of this lamella. On the other hand, it is highly probable that the compact position of the neck of the human malleus, on which the S-

shaped crest sits, corresponds to the above named bony lamella of the mammalia. A little eminence for the tensor tympani rises close to the root of the manubrium and on its inner side, which corresponds to the *proc. muscularis* of the mammalian malleus. The human *proc. gracilis* or *longus* exists in animals in full length, and in them is secured to the manubrium by the bony lamella. In man, the manubrium is short, and forms with the neck an angle of 140° . Its base is broader in man than in apes, more flattened laterally, and slightly convex; its end is spade-shaped; and the *proc. brevis* is well developed. The length of the body of the *incus* is greater than the height; the *crura* are very divergent, and the posterior leg (*proc. brevis*) lies very high; it is thick and long as compared with other animals. The long process tapers gradually, and unites with the *os Sylvii* by a relatively thick pedicle. The human stapes is characterized by its large opening, although this is not a canal, as in other animals; its head is comparatively small, and the anterior crus the straighter of the two; the foot-plate is longer in the horizontal direction.

The auditory ossicles of man, the troglodytes and simia resemble each other. The malleus of the hylobate (gibbon) conforms more nearly to those types than to those of the inferior apes, but the two other ossicles indicate a less highly developed type.

The ossicles of the troglodytes niger correspond to the general form of those of man; but as regards the head and the direction of the articular surface of the malleus, the simia comes nearest to man. The malleus of the gorilla is less like that of man than that of the chimpanzee, because the outer segment of the articular surface is very broad; while its manubrium resembles that of the simia. On the other hand, the *incus* and stapes of the gorilla are much like those of man.

The ossicula of the long-tailed monkeys (*cercopithecidae*) have very different characters, most prominent in the macaquo; *a*, a very short malleus, with marked constriction of its neck, and a manubrium set at an obtuse angle with the rest of the bone, having a *proc. brevis* and a *proc. muscularis*; *b*, an anvil, with a high and slender body; *c*, a stirrup, with a narrow space between the *crura*. The *semnopithecus* resembles the simian family as to the anvil and the lateral compression of the head of the malleus, but it is like the other apes of this group as to the neck and manubrium. The head of the malleus of the long-tailed monkey is well developed and prominent, while its *incus* is high and

slender. The colobus, cercocebus, macaquo, cynopithecus and cynocephalus have a flat and poorly developed head of the malleus and incus, and a short neck, in which relations the apes of the old world are more like the cebidæ than man. The platyrrhini (broad, flat-nosed apes) differ essentially from the apes of the old world in this, that with the exception of the ateles, they have no, or a partial, hammer-neck, while that of the ateles is peculiarly shaped. The hopalidæ have a malleus similar to that of the nycticebidæ (nocturnal, long-tailed monkey); and their stapes, in the partial fusion of the crura, resembles that of the edentata and marsupialia; such a fusion happens occasionally in the hopalæ and midas (tamarin). While the ateles departs from all other cebidæ in the shape of its malleus, its incus is shaped like that of the cebus (So. American Sapajou); on the other hand, the cebus is more like the mycetes in the absence of the malleus. The mycetes and pithecium (little ape) resemble each other, in having a prominent and slender incus. Of the lemurs, the galago (quadrumanæ of Madagascar), the nycticebidæ and propithecus harmonize with the small cebids. The genus lemur has the neck of the malleus and a rudimentary proc. brevis; it, or the indri (of Madagascar) possess a bony canal between the crura of the stapes, not observed in the galago, the loris (of East Indies) and the tarsier.

The ossicles of the carnivora are very similar. The malleus alone presents differences in families. A thin bony lamella is always constant between the neck of the malleus and the proc. gracilis (except in the herpestes [creepers]), as well as a proc. muscularis in the tendon of the tensor (except in bears, says HYRTL). In dogs and cats the proc. muscularis is long and bent; in dogs the manubrium forms an anterior concavity, and the outer surface of the membrana tympani is broad; in cats there is no curve, and the outer surface is narrow. In the hyæna and proteles the proc. muscularis of the hammer is thick and straight, and the manubrium is bent as in dogs; in the hyæna it is broad above, sharp below; in the proteles it is broad throughout. In both species the bones are more like those of the dog than of the cat. The weasel and the whole family of mustelidæ are distinguished from the rest of the fissipeds by the narrow lamina of the malleus and the obtuse angle between the handle and neck of the malleus; in them the proc. muscularis is as well developed as in cats and dogs, but they are inferior to the

bears and procyonidæ in the length of the posterior crus of the anvil. In the little weasels the base or the stapes is distended like a porch. The herpestes and suricata (So. Africa) are distinguished from the viverridæ by the greater development of the head of the hammer, a deficient lamina, and a proc. muscularis on the inner edge of the manubrium; the incus is like that of the felis, viverra and canis, and not as in bears.

The head of the malleus of the whale is like that of the phoca, but its handle is remarkably short; the incus is also like that of the phoca, but the stapes of the trichecus is more like that of the macrorhinus. The malleus of the latter is like that of the stenorhynchus, whose stapes and that of the cystophora resembles that of the phoca. A second, not constant, articulation exists between the malleus and incus only in the phocinæ. In the ungulata (hoofed animals) the laminated form of the hammer prevails, the proc. muscularis is not wanting, but remains short; the anvil is very variable; the stirrup is often quadrangular on account of a large breadth of head.

In the cow, antelope, giraffe and deer, the head of the hammer is always slightly developed, the proc. muscularis is constant, and the manubrium is often very long. In the adult ox, the narrow articular surface, the bent position of the manubrium, the high, strong anvil with its long, divergent processes, and the quadrangular shape of the stapes, are characteristic. In the adult sheep, the articular surface is deeper, the manubrium straight, and the anvil has a fair development. Most of the bovidæ resemble the lamb and sheep. The wild sheep, the goats, and the small antelopes are very much like the young ram. The gazelle has a hammer like that of the ox, but the stirrup is triangular, and the anvil resembles that of both sheep and ox. * * *

The burrowing rodents present some remarkable peculiarities of the ossicles. The geomys (field-mouse) has a malleus like the marmot, and a pouch-shaped stirrup. The two (three?) species of elephants have ossicles more like the rodents than the ungulates.

5. FLESCH recommends 100 per cent of distilled water, $\frac{1}{10}$ per cent. of osmic acid, and $\frac{2.5}{100}$ per cent. of chromic acid; for the complete expulsion of lime he uses a solution of chromic acid $\frac{1}{4}$ to $\frac{1}{2}$ per cent. Preparations are quickly made by this solution, after lying in a spirit, and there is no necessity of resorting to vegetable colors, as carmine, hæmatoxyline, etc., to sharpen the makroscopic picture.

6. ZUCKERHANDL had the opportunity of seeing the following defects in the skeleton of the face : 1. Absence of the true nasal cartilages, with atrophy of the lateral masses of the ethmoid. 2. Absence of the zygomatic arches (?), with abnormal segmentation of the sphenoid, and absence of the nasal bones.

Z. concludes that at birth a primordial cartilage exists under the nasal bones, covered with thick, easily-separated connective tissue, extending into the ethmoid.

The basal cartilage is arranged in the form of the lamellæ, hanging side by side in the middle line, separated by a deep furrow. At the depth of the furrow the lamellæ unite in the septum nasi. The lamellæ diverge from each other under the crista galli, so as to unite with the cartilaginous wings and thus a horizontal cavity is formed, which is filled with a thick, vascular connective-tissue plug of the dura mater. The author continues the description with great fulness. * * *

He observed the following forms of ossification : 1. The nasal septum extended down to the free border of the nasal bone, and was entire bone ; its wings were ossified also, and lay like little crests under the medial portion of the nasal bones. 2. The nasal spine of the frontal bone extended downward, the cartilaginous wings had an independent ossification, and united with the nasal spine and later the nasal roof. 3. The inferior portions of the wings alone were ossified and joined to the septum, while the upper parts were absorbed. 4. One wing was ossified, the other remained cartilaginous. 5. Ossification took place asymmetrically, *i.e.*, more extensively on one side than on the other. Z. found certain ossicles of different size and shape, which, from their position, he calls *ossicula subnasalia*. 6. The lowest part of the nasal septum was entirely independent, and was provided with processes on either side, which, without doubt, follow the ossification of the same basal cartilage. 7. The ossified wings were connected with the nasal spine of the frontal bone by means of a small bridge of bones, and anterior to them in the median line lay a little bone (part of the septum). 8. Ossicles, round and polygonal, of the size of hemp-seed, lay in the shallow groove on the inner surface of the mastoid bone, and had a circumscribed point of osseous union, either with the septum or with the nasal bones.

Z. found at birth and in the earliest years of life, lamellæ of cartilage on the anterior and inferior surfaces of the sphenoid, on either side of the rostrum, which extended forward to the car-

itilaginous portion of the ethmoid, and even to the septum nasale. These lamellæ were covered with a very thick multilamellar connective tissue, in which the bones of Bertini were developed. This connective tissue extended to the inferior surface of the body of the sphenoid toward the body of the occiput, and was in continuation with the fibrous substance of the basilar portion of the occipital bone. Other ossicles were occasionally found in the groove between the pterygoid process and body of the sphenoid, and the sphenoidal process of the palate bone. Z. styles the accessory ossicles, as well as those of *Bertini*, OSSICULA SUBSPHENOIDALIA.

7. URBANTSCHITSCH found in a male embryo of three months, the cartilaginous hammer and anvil perfectly formed, with a joint-furrow between both ossicles. Microscopic sections, taken in the long axis of the malleo-incudal joint from above downward, failed to show a completely peripheral articulation between hammer and anvil; only a partial cartilaginous union existed between the ossicles. This union was especially confined to the central portion of the inferior surface of the joint; the periphery of the inferior and the whole superior surface being fully exposed to view. These facts go to corroborate the views of Rathke and Valentin, that the hammer and anvil have one and the same common origin, and are not two distinct and separable parts.

8. ALBRECHT finds on either side of the body of the atlas of the axolotl (a tailed batrachian) a large concave surface for articulation with the angle of the ex-occipital bone; and between the two depressions projects an odontoid process. A. finds that the development of the process proceeds in this way: the lateral (parachordal) cartilages of the cord form an early union with the adjacent cartilage of the atlas. Ossification of the basi-occipital segment of these lateral cartilages proceeds equally toward the cord, until the basi-occipital becomes separated by an intervening joint from the ex-occipital cartilages. On the other hand, the segment of these lateral cartilages between the labyrinth, or the later otocysts, do not ossify. A. proposes to call this interotic segment of the basilar cartilage, which was earlier a part of the basi-occipital, the basiotic cartilage.

9. LOEWE made microscopic examinations of the nose and mouth of a young rabbit two months old, making 1,000 sections extending from the hair and skin of the anterior part of the head and face to the middle of the olfactory bulb.

The method of preparation of such large frontal sections, capable of being seen in every part of the field with immersion-lenses, is as follows: The whole fresh head is first hardened in a very large quantity of a concentrated solution of bichromate of potash, which at the same time removes its lime. After several days of washing in fresh water, the head is stained through in a large amount of a 1 per cent. solution of ammoniated carmine, a procedure occupying several months. After repeated washings the stained head is saturated with Klebs' glue-glycerine mixture, then hardened in alcohol, and finally sections are made upon L.'s microtome by means of a knife, four pounds in weight and two feet in length. The whole process of final preparation for the microtome demands at least a year.

L. describes the construction of the nose in its six different regions. He finds a groove with cavernous walls on each side of the projecting bony crista of the roof of the nasal cavity, the ductus tecti narium. It is a short, entirely mucous canal, running backward, then downward, 3 to 4 *mm.*, and finally bifurcates in a membranous fold on the lateral wall of the nose; the two branches represent the confluent excretory ducts of the glands of the antrum of Highmore. The mechanical importance of the groove at the roof of the nasal cavity is as follows: Grant, for the moment, that no groove exists, but that each one of the little acinous glands empties separately into Highmore's cavity. With every catarrh an increased secretion of these glands, and a greater flow of fluid into the cavity, must naturally follow. This liquid must become stagnant in consequence of the want of a canal of exit, until the level of the antrum of the cavity is reached. Thus, with every cold a fresh nidus of infection would be produced, were it not the province of the groove in the roof of the nasal cavity to carry off the secretion. The rabbit has four turbinated bones, of which the three inferior are homologous to those of man. When four scroll-bones are found in man, the superior one is rudimentary, and is a narrow, oblique ridge, with a rounded posterior end, whose direction is the same as that of the next inferior turbinated bone lying 1 to 2 *mm.* below it. A lymph-gland is found in the posterior third of the nasal septum at the end of Jacobson's organ, whose enlargement may be taken as the well-known flat polypoid growths found in this region.

The whole nasal skeleton, with the exception of the inferior turbinated bone, is originally formed in cartilage, and is a sac

symmetrically divided in two parts by a perpendicular layer of cartilage, completely shut, except on its anterior, inferior, and posterior walls, where a slit-shaped opening is found; this opening persists through life—anteriorly as the anterior nares, posteriorly as the infundibular opening of the posterior nares, while inferiorly it is closed by the alveolar processes of the superior maxilla, and the internal plates of the pterygoid processes. The antrum of Highmore lies external to this cartilaginous nasal capsule of the primordial cranium, and is surrounded by bone.

Over the second molar tooth of the superior maxilla there is a cavity surrounded by connective tissue, in which run the superior dental nerve and the superior dental muscle. The nose of the rabbit is so arranged, that the upper and olfactory portions of the cavity are completely separated from the respiratory portion by a bridge extending from the lower to the third turbinated bone (middle turbinated of man); so that an intermediate recess is formed between the superior maxilla and nose. A pair of small ganglion-knots of the fifth pair lie on this wall.

The whole nasal cavity of the rabbit, with the exception of the entrance, is lined with ciliated epithelium. L. and Exner regard Brunn's memb. limitans olfactoria, not as an independent formation, but as vibratory cilia in close union, or as a ciliated bed. The simplest forms of epithelium are found in the inferior (fourth) turbinated bone. It consists of two layers, which may be called the superior and inferior typical layers. The inferior typical stratum consists throughout of a layer of round cells. The superior stratum consists of cylinder cells, already in a state of peculiar disintegration. A fissure exists between the nucleus and protoplasmic capsule of the cell, which is at first very small, but finally divides it into two secondary (daughter) cells: 1. The proper nucleus, which remained free; and 2. The triangular, quadrangular, or polygonal protoplasmic corpuscle, without a nucleus. From the isolated nuclei came the epithelial cells of Max Schultze, while the olfactory cells are derived from the protoplasm, and rest upon the sub-epithelial connective tissue through the connection of their pointed processes, which run between the round cells. The earliest sign of the nuclei of the olfactory cells appears in these processes. These nuclei, when fully developed, lie one stratum deeper than the nuclei of the epithelial cells, whose position is taken by every olfactory in regular succession; and it becomes a natural question, whether we

have to do with an epithelial or an olfactory cell. Although it is so easy to distinguish between these two elements, when taken from the region of the highest olfactory power, it is equally difficult to determine to which class an isolated cell belongs, when taken from any other part of the nasal region.

10. PRITCHARD finds the epithelium of the whole ductus cochleæ formed of cubical cells in a single layer. The concavity of the lamina spiralis is filled with cylindrical epithelium, having three or four nuclei. A short time before birth the cylindrical cells became flattened down to the level of the cubical cells of the sulcus spiralis. Of the five proper cells of Corti's organ, the most internal divides into a broad superior, and a narrow inferior portion, while at the same time the third, fourth and fifth cells form a large superior and a small inferior nucleus. During this time the second cell has preserved its single nucleus, from which are to come the pillars of the arch, while the other four go to form the hair cells and the cells of Deiters. The external wall of the third, fourth and fifth, and the internal wall of the first cell, became the vertical hair threads. The second cell is first triangular, or its nucleus falls to the lowest part of the cell. It then divides into two approximate nuclei, between which appears a vacuole, which is the first evidence of Corti's arch. The memb. reticularis comes from the union of the superior ends of the original cylinder-epithelium, while its meshes probably originate from the absorption of the centre, and thickening of the edges. The vertical hair threads are in intimate connection with the memb. reticularis, through whose intervention it is connected with the memb. basilaris. These vertical filaments, formed as above described, from the first, third, fourth and fifth cells, P. regards as homologues of the radiating filaments of the retina; and with Waldeyer considers the memb. tectoria a structureless membrane, in which originates the primary layer of epithelium. The supporting cells of Hensen are the unchanged products of primary epithelium.

11. PETZIUS finds certain peculiar characters in the membranous labyrinth of the ray and shark, which are described at length.

ABSTRACT OF AMERICAN OTOLOGICAL LITERATURE FOR THE LAST QUARTER OF 1879.

BY SWAN M. BURNETT, OF WASHINGTON.

1. *Diseases of the middle ear. Otitis media*, by C. S. Turnbull, *Med. and Surg. Rept.*, Aug., 23.

A lecture before the Delaware Med. Soc., in which the anatomy of the middle ear and the subject of otitis media are discussed. It is a good *résumé* of our knowledge of these subjects.

2. *Otitis media purulenta chronica*, by H. G. Cornwell, *Cin. Lancet and Clinic*, Oct. 4th, 11th, 18th, 25th. Nov. 1st, 8th, 15th.

These papers contain a very good account of our knowledge of this disease, as gathered from various publications and text-books. No original observations are given. A very good bibliography of the subject is appended.

3. *Horn-bug in external meatus auditorius for fifty-four years*, by W. W. Seeley, *Cin. Lancet and Clinic*, Dec. 13th.

A medical gentleman got a horn-bug in his ears when six years old. It was killed by pouring camphor into the ear. It was not removed at the time, but fifty-four years afterward he removed it when feeling some uneasiness in the ear after a blow on the head. During all this time it had occasioned no trouble whatever.

4. *A singular plug in the meatus*, by F. C. Hotz, *Chicago M. J. and Ex.*, Oct.

These plugs which were taken from a clown in a pantomime who whitened his face with a mixture of bismuth and lard, were found to consist of cerumen, lard, fine hairs, and a heavy yellow white powder, which, on chemical examination, proved to be oxychloride of bismuth.

5. *Otitis media purulenta, spontaneous perforation of the mastoid antrum*, by T. R. Pooley, *Archives of Med.*, Oct.

In a patient of Dr. P's, an incision was made down on the mastoid for the usual symptoms of purulent catarrh with implication of the mastoid. The bone was found healthy and no perforation was made, but the wound was kept open. The patient obtained temporary relief. In the course of some days, however, the violent symptoms returned, and it was finally decided to trephine the bone; but on removing the poultice a quantity of pus was found on it, and it was discovered that nature had been before the surgeon. The opening was enlarged and a drainage tube of soft metal introduced. This tube he considers a valuable aid in the treatment of such cases. It consists of a tube 1 mm. in thickness, and 35 cm. long, with a flange at one end and several holes in the side. The patient made a good recovery.

6. *Purulent inflammation of the middle ear*, by F. O. Green, *Bost. Med. and Surg. Jour.*, Nov. 25th.

Dr. Green gives the histories of two cases of purulent inflammation of the middle ear to illustrate the importance of early operation on the mastoid where oedema behind the ear points to a collection of pus in the mastoid cells.